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MANUAL
OF
NORTH AMERICAN DIPTERA

S. W. WILLISTON

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MANUAL

OF THE

FAMILIES AND GENERA

OF

NORTH AMERICAN DIPTERA

SECOND EDITION

REWRITTEN AND ENLARGED

BY

SAMUEL W. WILLISTON

PROFESSOR OF PALEONTOLOGY AND ANATOMY
UNIVERSITY OF KANSAS

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JAMES T. HATHAWAY
297 CROWN ST. NEAR YALE COLLEGE

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PREFACE.

Eight years ago the author of the present work published a small volume in which he attempted to tabulate the families and more important genera of the diptera of the United States. From the use that has been made of that work by entomological students, he has been encouraged to believe that the labor of its preparation was not in vain. The extraordinary activity in the investigation of our dipterological fauna within the past few years has, however, largely destroyed its usefulness, and it is hoped that this new edition, or rather this new work, will prove as serviceable as has been the former one. In the present work there has been an attempt to include all the genera now known from north of South America. While the Central and West Indian faunas are preëminently of the South American type, there are doubtless many forms occurring in the southern states that are at present known only from more southern regions.

In the preparation of the work the author has been aided by the examination, so far as he was able, of extensive collections from the West Indies and Central America submitted to him for study by Dr. D. Sharp of Cambridge, England, and Messrs. Godman and Salvin of London, together with the extensive collections of the University of Kansas and those from South America in the author's private cabinet, altogether forming probably the largest collection of American

Diptera ever brought together. For the descriptions of the early stages reliance has necessarily been placed chiefly upon the writings of Brauer. As will be seen, assistance has been derived from the works of Schiner, Osten Sacken, Loew, Wulp, Townsend and others, although but very few of the North American genera, aside from those of the Tachinidæ and Dexiidæ, are unknown to the writer.

The author owes his sincerest thanks to Prof. J. M. Aldrich for the family characters and table of the Dolichopodidæ; to Prof. V. L. Kellogg for the paragraphs on the internal anatomy of Diptera; to Prof. J. B. Smith for kind favors; and to Prof. W. A. Snow for the table of the Ortalidæ.

LAWRENCE, KANS., June 10, 1896.

CORRIGENDA.

Page viii, line 9, for 'writer' read student.
x, line 10, for 'hemispherical' read spherical.
xix, line 5 from bottom, for 'Cyclorrhapha' read Orthorrhapha.
18, line 2 from bottom, insert not before 'forked' and delete from the following line.
31, line 4 from bottom, for 'anal cell closed' read discal cell open.
32, line 2, for 'THAMBETA Williston' read DIOTREPHA Osten Sacken.
35, line 14, for '5' read 3.
40, line 13 from bottom, insert flattened before 'cylindrical', and, three lines below, read 'tibiæ with or without spurs.'
43, last line, for 'SUBULA OMYIA, nom. nov.' read XYLOMYIA Rondani.
58. line 13, for 'ORTHONEUROMYIA Williston' read PSILOCURUS Loew.
88, line 17 from bottom, for '64' read 67; line 6 from bottom for '67' read 65.
96, line 15 from bottom, for 'Eumyidæ' read Holometopa; line 11 from bottom, for 'Schizophora' read Eumyidæ.
140, line 3, for 'with' read without.

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INTRODUCTION.

The order of two-winged insects, known as flies or Diptera, includes nearly forty thousand known species from different regions of the world. Since many of the species are very small or minute, and inconspicuous, and as the order has received only a small share of the attention of collectors and students, there certainly remain very many more to be yet made known. From North America not far from four thousand species have been studied, and we probably have as many more awaiting discovery. Our knowledge of the dipterological fauna has progressed with increased rapidity during the past ten or twenty years, but vast fields for profitable study yet remain open for the serious investigator. In North America the results to be obtained are almost inexhaustible. Nearly every family yet awaits the conscientious monographer. The description of new species is the much less interesting of the work to be done, and perhaps the less profitable. At the present time the rapidly increasing number of short papers descriptive of new forms is rendering the determination of species more and more difficult.

To the student beginning the study of this interesting group of insects, some words of advice or caution may be of service. The present work can make no pretensions to completeness in the characterization of genera, and he should never depend upon mere tables in the absence of other information. Doubt of the right generic location of a specimen may often be surest dissipated by attempting to refer it to some species. Until the student has acquired a sort of intuitive acquaintance with the different families the work may be somewhat tedious, but by

perseverance he can not fail to overcome whatever obstacles families and genera may present. He will be very much aided at the beginning by having a tolerably large collection at his command by which to make comparisons. Difficulties will often disappear with positive evidence before him, where negative characters are puzzling. With each genus in a family positively determined the difficulties and uncertainties of others will gradually disappear.

To determine his species the student will need access to a large number of papers, lists of which to the present time will be found in the catalogue of Osten Sacken, and on page XXXIII of the present work. There are a few masters of dipterology, and the student will never err in consulting their writings, no matter upon what subjects they may be. Of these I would especially mention Meigen, Wiedemann, Winnertz, Loew, Schiner, Osten Sacken, Wulp and Brauer. Other writers whose works are indispensable, but who are not to be trusted as guides, are Desvoidy, Macquart, Walker, Rondani, Bigot, etc. Of the contemporary writers whose works will be found useful, and in most cases valuable, may be mentioned Austen, Eaton, Meade and Verrall of England; Bergenstamm, Kowarz, Mik and Strobl of Austria; Becker, Girschner, Roeder and Ruebsamen of Germany; Dziedzicki and Schnabl of Poland; Bezzi and Giglio-Tos of Italy; Bergroth of Finland; Skuse of Australia; the Lynchs of South America; Aldrich, Banks, Coquillett, Johnson, Scudder, Snow, Townsend and Wheeler of this country. Probably the most useful single work that the student will find after Osten Sacken's Catalogue (Smithsonian Ins. 1878) is Schiner's Fauna Austriaca, and the most useful foreign periodical the Wiener Entomologische Zeitung, of which the accomplished Mik is one of the editors. The Zoölogical Record will be almost indispensable in ascertaining what has been done during the past thirty-six years. For the beginner I would especially recommend Comstock's Manual for use in conjunction with this work.

Diptera may always be recognized by the presence of but one pair of wings; the second pair of other insects is really represented by a small organ on each side back of the true wings, consisting of a short, slender stem with a knob-like termination, called the halteres or poisers. Their function is not known; that they have some function seems certain, as they are always in vibration during flight. Not all flies are winged; in some degraded forms, both among the lowest and highest groups of the order, they may be entirely wanting, as also the halteres. Sometimes the males will have wings and the females be wingless. But the number of wingless forms is very small.

In the adult state the habits of flies are very various. Some, but not a very large proportion, are predaceous upon other insects, sucking their juices. Some are very annoying to man and other warm-blooded animals, sucking their blood; of these may be mentioned the mosquitoes, black-flies, horse-flies, stable and horn flies, the tsetze fly, etc., as well as all the pupipara, which are parasitic upon birds and mammals. By far the largest number of diptera, however, feed upon vegetable substances, either fresh or decaying, the pollen and honey of flowers, etc. Some feed upon ordure and decaying material of whatever nature it may be.

In the larval stages, the habits are yet more diverse. Brief references to the larval habits will be found in the following pages. Suffice here to say that the larger part are vegetable feeders, but not a few live upon decomposing animal matter, or in the living bodies of other insects, snails, reptiles, birds, mammals, etc. While some members of the order may be very annoying or prejudicial to man's economy, the order, upon the whole, is a beneficial one, whether in the larval or mature stages, whether as parasites upon other, and injurious organism, or as scavengers.

In the following pages I endeavor to give such definitions and descriptions of the mature insect as will enable the stu-

dent to understand and appreciate, not only the present work, but all other systematic works upon diptera. I have not thought it desirable to consider at length many interesting subjects connected with them, such as the internal anatomy, embryology, etc., as being rather apart from the object of the work,—an introduction or, aid to the study of systematic dipterology.

HEAD.

The head in diptera is extremely variable in shape, reaching its most remarkable development in the Diopsidæ and Nycteribiidæ. It is frequently more or less hemispherical, but more often the posterior surface or *occiput*, is flattened or even concave, giving a more hemispherical form. Often it is flattened and widened transversely as wide or wider than the thorax. In the Nycteribiidæ it may be folded back into a groove on the dorsum of the thorax, but with those exceptions, it is always attached to the thorax by a freely movable neck. Next to the wings, the head offers the most important characters for classification.

Eyes. The large compound eyes are present in all diptera save some Pupipara. In the great majority of males they are contiguous on the upper side of the head for a greater or less distance; in such cases the insects are called *holoptic.* In many males, however, (all the Acalyptratæ and several families of the Orthorrhapha, as well as in numerous genera of other families) and in all females with but few exceptions (some Acroceridæ, Blepharoceridæ, Bombyliidæ and Platypezidæ, etc.) the eyes are separated more or less broadly by the front; such insects are called *dichoptic.* Rarely the eyes may be contiguous below the antennæ or both above and below them, as in the Acroceridæ. In not a few flies, especially those of the aerial eremochætous kinds, the upper facets of the eyes are larger and more conspicuous than the lower ones, sometimes separated by a distinct line, or even entirely divided. In these flies especially, the eyes in life are often

brilliantly and beautifully colored with green and purple markings. Sometimes the enlargement of the facets is on the anterior portion and common to both sexes, as in the Asilidæ. The larger number of flies have the eyes bare, or pubescent only when seen under high magnification. Very often, however, the whole or part of the eyes is covered with erect pile or hair, which always finds its greatest development in the male sex. The pilosity may be sparse or dense, short or long.

Ocelli. On the upper part of the head, between the compound eyes there are three simple, small eyes, present in most diptera, and called the ocelli. They are by no means constant among all the genera of some families, or even among all the species of some genera. They are usually situated in the form of a triangle whose apex is in front; sometimes they are located in a nearly straight line transversely, or, the middle one may be absent, and the other two situated one on each side close to the compound eyes.

Antennæ. No other organs furnish so many or so important characters in the classification of the diptera as do the antennæ or feelers, as they have been sometimes called. The number, shape, and arrangement of the joints offer, not only specific and generic characters, but in some cases family characters as well. Only in exceptional cases is the number less than three, and there may be as many as thirty-six, it is said. Through all the Cyclorrhapha the number three is constant, with the exception of the Phoridæ, and the Pupipara. In the Nematocerous Orthorrhapha the number is usually from eight to sixteen, the first two of which form the *scape*, and which are always more or less differentiated from the remainder, which constitutes the *flagellum*. Osten Sacken has proposed to call those flies which have the antennæ long and frequently bearing whorls of hairs, especially in the males, the *true* Nematocera, in distinction from the *anomalous* Nematocera, in which the antennæ are shorter, destitute of whorls of hairs and with the joints pressed close together. Upon the antennal

character alone, however, the group can not be satisfactorily separated from the *anomalous* Brachycera, in which the antennæ are more usually three-jointed, with the third joint divided into segments. Nor can the latter be clearly separated from the *true* Brachycera, in which the third joint is not annulated. Sometimes the third joint appears to resemble that joint in the *true* Brachycera, but will be found upon close inspection to be composed of a number of closely united segments or annuli, and it is in these cases that the term *complex* is applied. This character will be easily understood by examining the third antennal joint of a common horse-fly. Either the complex or the simple third joint may terminate in a bristle, usually called an arista, or in a style, that is a more slender portion, which is, however, not bristle-like. It is very evident that both the style and the arista represent only the more or less attenuated distal joints of the flagellum, because in all cases a close examination will show them to be composed of from two to five segments. The arista or style is frequently entirely wanting in the Orthorrhapha, but only rarely is it atrophied among the Cyclorrhapha. The style is always terminal, because it is less differentiated from the flagellum, but the arista may be either terminal or dorsal, and it may be inserted close to the base of the third joint. It is also evident here that the change of position is more apparent than real, because it is in reality due to the greater development of the under side of the third joint. In some cases the third joint has developed into most singular structures, as for example in *Neochauna* and *Blastocera* among the Stratiomyidæ, or *Talarocera*, *Schizotachina*, *Dichocera* and *Diglossocera*, among the Tachinidæ.

Frequently the arista has short hairs growing from its upper and lower sides, in which cases it is called *pubescent;* when the hairs are longer and more feather-like, the arista is said to be *plumose;* or, if the hairs are fewer and stronger, *pectinated.* The plumosity or pectination is always stronger on the upper side of the arista.

Front. The space between the eyes in all dichoptic flies, limited by the upper margin of the head and the line drawn through the root of the antennæ is called the front. It may be wide or narrow, excavated or convex, etc.

Vertex. The uppermost part of the front, near the margin of the occiput, which is here called the *vertical margin.*

Vertical triangle. The triangle at the upper part of the head, between the eyes in holoptic flies. It bears the ocelli, which when placed on a triangle indicated by grooves or depressions is called the *ocellar triangle.*

Frontal triangle. In holoptic flies, the triangle between the eyes and the root of the antennæ, the apex of which is above.

Ptilinum. In the Cyclorrhapha an inflatable organ capable of being thrust out through the frontal suture just above the root of the antennæ, and which is used by the imago in springing off the cap to the puparium when about to extricate itself.

Frontal lunule. An oval or crescentic space just above the root of the antennæ in Cyclorrhaphous flies, bounded by the frontal suture.

Epistoma or *Peristoma.* The oral margin and an indefinite space immediately contiguous thereto.

Antennal fovea. A groove or grooves in the middle of the face, as though for the lodgment of the antennæ, bounded on the sides by the *facial ridges.*

Cheeks. The space back of the face and below the eyes.

Orbits. The space immediately contiguous to the eyes, sometimes indicated by structural characters, at other times indefinite. It is called facial, frontal, etc., from the position.

Clypeus. A part of the mouth structure, often visible below the margin of the mouth in front as a more or less visor-shaped piece.

MOUTH-PARTS.

The mouth-parts of diptera are wholly suctorial. They differ not a little in the different flies, as might be supposed

from the diverse habits. In some they are adapted for piercing animal or vegetable substances and are, in consequence, firmer and more slender; in others, and by far the greater number, they are adapted only for sucking up juices or such substances as may be dissolved by the aid of the saliva. Grains of pollen have been observed in the digestive organs of the Syrphidæ and other flower flies, but, as a rule, fluids only serve as food. Many have the proboscis wholly retractile into the oral cavity, and furnished with one or even two hinges, by which when at rest it may be folded up. In others the proboscis is not retractile, and projects either in front, or downward or backward, beneath the body. While it is usually short, it may be much longer than the body. Finally a few species have the mouth-parts rudimentary and take no nourishment in the adult state.

As regards the different parts of which the mouth-organs are composed, there is a strong contention on the part of Prof. John B. Smith that the homologies previously and generally accepted by entomologists are not the correct ones. I have followed his arguments as carefully and as fully as I am able, but I will not pretend to assert any authoritative opinion in the matter, as that would presuppose a thorough acquaintance with the mouth-structure in other insects than the diptera, which I do not possess.

The more commonly accepted homologies are as follows: labium, maxillæ, maxillary palpi, mandibles, hypopharynx, and labrum or labrum-epipharynx. The labial palpi are thought to be wholly wanting, or represented by the labella. The labium is always present, more or less fleshy and provided with muscles. It is grooved or channeled on the upper side to receive the other parts, with the exception of the palpi, which are free. This sheath is often nearly complete, the thin margins touching each other above. At its tip are the pair of joints of variable size called the "lips" or labella. The maxillæ and mandibles are sometimes absent, the mandi-

bles most frequently; when present they are always slender and firm. The hypopharynx is unpaired and slender, grooved on the upper side and sometimes converted into a nearly complete tube. The labrum, also unpaired, is usually elongate and grooved on the under side, forming by apposition with the pharynx a complete tube. The mandibles are frequently absent; in fact I do not know of their occurrence in any flies with a simple third antennal joint, and they may be absent in the male when present in the female, as in the Tabanidæ. They are always piercing organs, thin, firm, chitinous and usually slender. The two maxillæ, likewise piercing organs, find their highest development in such predaceous flies as the Asilidæ. Like the mandibles they are chitinous and slender. In some they are more or less flattened, and may have curiously shaped projections at the tip; usually they are bristle-like. They lie with the maxillæ within the sheath of the labium, at either side of the labrum and hypopharynx. In some cases the labrum is short, and serves only as a cover for the proximal part of the hypopharynx, but usually it is as long as or longer than the hypopharynx and has a simple groove on the under side. The hypopharynx is always present in flies in which the mouth-parts are functional. It is, more often a slender, firm organ, grooved upon the upper side, which by apposition with the labrum forms a distinct tube. In some, however, it may form almost a complete tube in itself.

Leaving out of account the degraded, but highly specialized Pupipara, the labium is always a sheath for all the other organs except the palpi, but is separable at the will of the insect. It is not used in piercing; it is either bent backward in the middle, as in the mosquito, or the piercing parts are thrust out at the extremity as in most of the predaceous flies. To facilitate this protrusion of the piercing parts, the proximal portion is more or less membranous and retractile; or, the inner organs may be capable of elongation, being coiled up in some cases, as in *Pangonia*, within the pharyngeal

cavity. The pair of organs at the extremity, the lips or labella, are very variable in shape, position and function. In the mosquito, for instance, they serve merely as a pair of fingers to guide the piercing parts. In many of the flower-flies with long proboscis, they are small, oval, divaricable organs, that seem to be chiefly sense-organs, as they are usually provided with hairs inserted into small, semi-translucent spots on the outer sides and margins. In the greater number of flies, however, the labella are of considerable size, and are provided with radiating ridges on the inner, opposable sides. These pseudotracheæ, as they are called, serve as means of attrition, by which the insects rub off particles of food from firm substances. Sometimes the labella are long and slender and folded back under the labium when at rest. In the Asilidæ and some others, they are rigid and horny.

Perhaps the most important of all the mouth-parts, from the systematic standpoint, are the maxillary palpi. They are always inserted at the inferior basal part of the proboscis, on a thin plate which bears the maxillæ, and are always extricated. Their study has been much neglected, and doubtless thorough comparative researches will reveal not a few characters of value in classification. They are variously described as being composed of from one to five joints. Probably there is never more than four articulated joints, the basal joint being merely a process of the plate bearing the maxillæ. The tendency in diptera is toward their entire loss, and in the most highly specialized families there is never more than one articulated joint. They may be reduced to the merest rudiments, even in flies which are more or less predaceous in habits and which have the mouth-parts with the exception of the mandibles, otherwise well-developed. They are never greatly elongated, save among some of the Nematocera.

Without going into Prof. Smith's arguments, he shows with what seems to be much force, that the real homologies of the dipterous mouth-parts are as follows:

Labrum.	Paraglossa.
Hypypharynx. . . .	Ligula.
Mandibles.	Lacinia.
Maxillæ.	Palpifers.
Maxillary palpi. . . .	Maxillary palpi.
Labium.	Galea.

THORAX.

The thorax is composed, as in other insects, of three parts, the *pro*-thorax, the *meso*-thorax and the *meta*-thorax, but the first and the last are so aborted as to present but few anatomical characters. The prothorax is perhaps most readily distinguished in the Nematocerous flies, forming a rounded *collar* back of the neck. The metathorax is not seen at all from above; the *scutellum*, cut off by an impressed line, usually a semi-oval body, really belongs to the mesothorax, the dorsum of which is often called the *mesonotum*.

Transverse suture, an impressed line usually running straight across the mesonotum and terminating a little in front of the root of the wings. It is more or less incomplete in the middle.

Humerus or *humeral callus*, the anterior superior angles of the mesothorax, usually a more or less rounded callus.

Post-alar callus, a more or less distinct rounded swelling, situated between the root of the wing and the scutellum.

Pre-alar callus, a similar, but usually less prominent, projection situated before the root of the wings on the sides of the mesonotum, just back of the outer ends of the transverse suture.

Scutellar bridge, a small ridge on either side of the scutellum, connecting it with the mesonotum.

Presutural depression, a depression, usually triangular in shape, at the outer ends of the transverse suture, near the dorsopleural suture.

Supra-alar groove, a groove on the mesothorax immediately above the root of the wings, along the inner margin of which there are, usually, characteristic bristles.

Dorsopleural suture, the suture running from the humerus to the root of the wings, separating the mesonotum from the pleura. Mik proposes for it the rather more appropriate term of *notopleural suture*.

Sternopleural suture, the suture below the dorsopleural suture, nearly parallel with it and separating the mesopleura from the sternopleura.

Mesopleural suture, the suture running from the root of the wings downward and separating the mesopleura from the pteropleura.

Mesopleura, the space situated in front of the root of the wings, between the dorsopleural and sternopleural sutures.

Pteropleura, situated below the root of the wings, back of the mesopleural suture.

Sternopleura, the lower part of the pleura, below the sternopleural suture and above the front coxæ.

Hypopleura, the space over the middle and hind coxæ, below the metapleura and pteropleura.

Metapleura, the "sides of the metanotum", a more or less swollen space at the outside of the metanotum and between it and the pteropleura and hypopleura.

Metanotum, the oval, arched portion behind, beneath the scutellum. It is frequently the best developed in the flies with long, slender abdomen, as the Tipulidæ.

Halteres, balancers or poisers, rudimentary posterior wings, a slender organ with a dilated head, situated below each metapleura.

Tegulæ or *alulæ*, a pair of membranous scales situated above the halteres and back of the root of the wings, one above the other. The lower one or both may be rudimentary or absent; the upper one moves with the wings and is called the antitegula by Osten Sacken. Comstock, however, objects to this use of tegula, saying that the term was first used for the cup-like scale above the root of the wing in certain hymenoptera, and should be reserved for that organ.

LEGS.

The three pairs of legs are attached to the prothorax, mesothorax and metathorax, and are called, respectively the front, middle and hind pairs. When the front and middle pairs are spoken of together they should be called, for the sake of exactness, the anterior legs; when the middle and hind pairs are collectively meant, the posterior legs. The legs are composed of five parts:

Coxa, the part attaching the legs proper to the thorax.

Trochanter, the short, small, ring-like portion between the femur and coxa.

Femur, almost invariably the longest and stoutest portion of the legs, often provided with tubercles, spines or projections or sometimes greatly thickened; usually slender.

Tibia, the next part succeeding the femur, and like it often with various ornamentations or projections. When it terminates in one or more distinct, short bristly spines, it is said to be *spurred.*

Tarsus, the distal division of the legs, composed (except in some abnormal forms) of five joints, of which the first, that next to the tibia, is called the metatarsus. On the terminal, or fifth joint, are the

Ungues or *claws*, usually two, curved movable hooklets on the under side of the last tarsal joint, at the base of which below, are a pair of

Pulvilli, two pad-like, fleshy cushions attached to the last joint of the tarsus below the claws, usually present, but often absent among the Orthorrhapha and often much larger and better developed in the male than the female. Between them, among a number of the families of the Cyclorrhapha, is the

Empodium, a median appendage on the under side of and between the claws, either in the form of a pad, like the pulvilli, when it is called pulvilliform, or like a bristle or spine; rarely it is alone present and the pulvilli wanting.

ABDOMEN.

The abdomen is composed of a variable number of segments, more or less closely fused together. The normal number for insects, nine, are rarely all visible (the Tipulidæ are examples). They are counted from the base on the upper side. In not a few cases the first two are so closely fused together, and the first one abbreviated, that the nomenclature leaves some doubt in the mind of the student. The upper part of the abdomen may be especially indicated by the word *dorsum*, but in general, the *venter* or under part is alone thus contradistinguished. The male genitalia, which in many cases are of complicated structure, and of much value in classification, are known collectively as the *hopopygium*, though Bergroth has proposed the name *propygium* for them. The *ovipositor* of the female abdomen very frequently projects from the abdomen, and is sometimes extremely long; its structure is often characteristic of genera or families. The more detailed description of the parts of both these organs it is unnecessary to go into here; they may be studied in the different families, where they often find useful application in the separation of species.

CHÆTOTAXY.

Until within recent years but little attention had been paid by writers on systematic dipterology to the number and arrangement of the bristles among flies. Osten Sacken, who proposed the term *chætotaxy*, to designate the science of their arrangement, published an epochmaking paper on the subject in 1881. Since that time their use has steadily increased with the most happy results. That they will become more and more useful as their study in different families progresses, there can seem to be no doubt. For that reason, it behooves the student to become familiar with the nomenclature already in use. The following are the most important terms:

Cephalic Bristles.

Vertical, two pairs, inner and outer, inserted more or less

behind the upper and inner corner of the eye, erect, or the inner pair convergent, the outer pair divergent.

Postvertical, in the middle of the upper part of the occiput, generally small or absent.

Ocellar, situated close to the ocelli, usually directed forward; often absent.

Fronto-orbital bristles, placed on each side of the front, near the orbit, immediately below the vertical bristles. There may be one, two or none on each side.

Lower fronto-orbital, situated on the lower part of the front, above the antennæ, along the orbit, and not quite in line with the fronto-orbital bristles. They are not of frequent occurrence.

Vibrissa, a stout bristle situated near the oral margin on each side. Of important use in the classification of the Acalyptratæ.

Facial, a series of bristles on either side of the middle portion of the face, above the vibrissæ, especially conspicuous among many genera of the Tachinidæ, but usually absent in the Acalyptratæ.

Thoracic Dorsal Bristles.

Humeral, one or more bristles inserted on the humeral callus.

Post-humeral, usually two, inserted immediately above the dorso-pleural suture, between the humeral callus and the root of the wing, on the bottom of the pre-sutural depression.

Pre-sutural, one or more bristles situated immediately in front of the transverse suture, above the pre-sutural depression.

Supra-alar, usually three bristles, one on the post-alar callus, one on the alar frenum and the third in front of the second on the edge of the supra-alar depression.

Intra-alar, a row of two or three bristles between the supra-alar group and the dorso-central bristles.

Dorso-central, two or four longitudinal rows on the inner part of the dorsum, sometimes represent by the

Prescutellar, a transverse row of bristles in front of the scutellum.

Thoracic Pleural Bristles.

Propleural, bristles inserted immediately above the front coxæ.

Mesopleural, bristles inserted on the mesopleuræ, in the angle formed by the dorso-pleural and mesopleural sutures.

Sternopleural, one or several bristles situated on the sternopleura, below the sternopleural suture.

Pteropleural, bristles inserted on the pteropleuræ, rarely present and difficult to distinguish.

Metapleural, bristles inserted on the metapleuræ, especially conspicuous in the Asilidæ, and named by Lynch the

Trichostical bristles, a fan-like row on the metapleuræ, conspicuous in some families.

Hypopleural bristles, a row or tuft of bristles on the hypopleura, occurring in the Calyptratæ.

Abdominal Bristles.

Marginal bristles, bristles inserted on the posterior margin of the segments, especially conspicuous in many Tachinidæ.

Discal bristles, bristles, usually one or more pairs, inserted on the middle of the segments before the hind margin.

Lateral bristles, one or more bristles situated on or near the lateral margins of the segments.

In addition, a number of terms are used to designate the inclination of the bristles, often important in describing the cephalic bristles. The more important of these are *erect*, when standing vertically, or nearly so; *proclinate*, when directed forward; *reclinate*, when directed backward; *divaricate* or *divergent* when directed outward from the middle line; *convergent* when directed inwardly; *decussate* or *cruciate* when crossing each other.

WINGS.

To understand the *neuration* or *venation* of the wings the student may select a common large horse-fly (Tabanidæ). Observe near the middle of the wing directed transversely, a large, oblong, five or six sided cell, surrounded on all sides by other cells. This is the *discal* cell and is present in nearly all flies. Somewhere on the vein (fourth *longitudinal*), that bounds this cell in front, will be seen a short connecting vein, directed anteriorly, the *anterior* or *small cross-vein*, which affords, in most cases, a key to the neuration, no matter how intricate. It always connects the fourth longitudinal vein behind with the third longitudinal vein in front (in a few rare cases the second longitudinal vein); the cell behind it is the discal, in front, between the second and third longitudinal veins, the *submarginal;* on the outer side the *first posterior;* on the inner side the *first basal.* Just back of the first basal cell and separated from it by the fourth longitudinal vein, is the *second basal cell;* back of the second basal and separated by the fifth longitudinal vein, is the third basal or *anal cell.* Back of the anal cell and including the free posterior proximal portion of the wing is the *axillary cell.* In the horse-fly the anal cell is seen to run back obliquely to near the posterior margin of the wing, where it terminates acutely, that is, the anal cell is closed near the border of the wing; should the two veins that close it run separately into the margin of the wing, then the cell is said to be open. Counting from the third longitudinal vein (posterior branch) backward along the posterior border of the wing, to the vein that closes the anal cell outwardly, the student will count five different cells, the first of which, as already said, borders on the first basal cell, the second and third on the discal cell, the fourth on the discal and second basal cell, and the fifth on the second basal and anal cells; these cells are called the *posterior cells*, and are numbered from before back; the first is bounded by the third and fourth longitudinal and the anterior cross-vein; the

second by the fourth longitudinal in front, the anterior intercalary vein behind, and the posterior cross-vein at the outer side of the discal cell; the third is bounded by the anterior intercalary, and the fifth longitudinal vein and the posterior cross-vein; the fourth is bounded by the fifth longitudinal vein in front and the posterior intercalary vein behind; the fifth by the posterior intercalary, the fifth longitudinal at the outer end of the second basal cell, and the *posterior basal cross-vein* at the outer end of the anal cell. The short vein which separates the second basal cell from the discal cell is known as the *anterior basal cross-vein.* Now, following the third longitudinal vein outwardly it will be found to give off an anterior branch which runs forward to terminate in the anterior border of the wing, or *costa;* the cell included between this fork and the vein itself behind is the *second submarginal cell.* The second longitudinal vein borders the first submarginal cell in front and terminates in the costa; between it and the first longitudinal vein which has a similar course and termination is the *marginal* cell; between the first longitudinal vein and the costa there is another parallel vein with narrow cells on each side of it, the vein is the *auxiliary,* and the cell before it the *costal,* behind it the *subcostal.* Finally, near the root of the wing there is a short cross-vein connecting the auxiliary vein with the costa; it is known as the *humeral cross-vein.*

The student is urged to procure a copy of Comstock's Manual of Insects for use in connection with this work. The figures there given of the various parts of the external anatomy of diptera and especially of the neuration, are the truest to nature that I have ever seen. The nomenclature of the wing-neuration there adopted, or some modification of it, is destined to supplant the Meigenian or Schinerian terminologies now almost exclusively used. I have not adopted it in this work for two reasons: first, that it has not yet been fully

crystallized into a permanent shape; second, because nearly all the existing literature has the nomenclature here employed and to use a new one would largely defeat the object of the work in the hands of the beginner. I give below the terminology used by Comstock, together with the equivalent terms here used and the equivalent ones in the terminology of Schiner, for the horse-fly.

Auxiliary vein	II	Mediastinal
First longitudinal	III1	Subcostal
Second longitudinal	III2,3	Radial
Third longitudinal	III5	Cubital
Fourth longitudinal	V2	Discoidal
Fifth longitudinal	V3	Postical
Sixth longitudinal	IX	Anal
Anterior branch of third vein	III4	
Anterior intercalary	V2	
Posterior intercalary	VIII	
Costal cell	2ndI	Costal
Subcostal cell	II	Mediastinal
Marginal cell	III1	Subcostal
First submarginal cell	III3	Cubital
Second submarginal cell	III4	
First basal cell	2ndIII	
Second basal cell	V	
Anal cell	VIII	
Axillary cell	IX	
First posterior cell	III5	
Second posterior cell	VI	
Third posterior cell	2ndV2	
Fourth posterior cell	V3	
Fifth posterior cell	VIII	
Discal cell	1stV2	

Flies differ very much in the nature of their covering. Many are nearly or quite bare; others have a thick, woolly covering of closely set, long fine hair; while others still have an abundant covering of long stout, heavy bristles or *macrochætæ*. Undoubtedly the kind of covering has much relation

with the habits of the mature insects, yet just what the relations are is not yet well understood. Osten Sacken has observed that the eremochætous flies (i. e. diptera in which there is a general absence of bristles, as for example the Stratiomyidæ, Leptidæ, and Tabanidæ) are for the most part holoptic in the male sex and at the same time are principally aerial flies, flying swiftly and with the habit of hovering, using their legs only for alighting. On the contrary the chætophorous flies (as the Muscidæ, sens. lat., Phoridæ, Dolichopodidæ, Asilidæ, etc.) use their legs as much as, sometimes more, than the wings for locomotion, and rarely have the eyes contiguous in the male sex. Probably the development of the macrochætæ reaches its highest extent among the Tachinidæ, as for instance in *Dejeania*, *Saundersia*, etc., and the Dexiidæ (*Hystrisiphona*, etc.), where the abdomen may be almost wholly covered with long and erect, very rigid spines.

As concerns other forms of covering, the usage of writers is not very exact; the terms *hair*, *pile*, *pubescence* and *tomentum* are used with a wide degree of latitude. In general, however, pile should be restricted to indicate close, thickly set, fine hair, as in the pile of velvet, while hair may mean longer, and less abundant. Pubescence should mean very short, fine hairs, while tomentum can only be correctly applied to recumbent, flattened scale-like or stubble-like hairs, which gradually merge into *dust* or *pollen*, which is so generally present in flies, and upon which the determination of many species must largely depend.

INTERNAL ANATOMY.

For the following brief account of the internal anatomy of Diptera I am indebted to Prof. V. L. Kellogg.

The special features of the internal structure of the Diptera are the high degree of concentration of the nervous system attained in some of the members of the order, the expansion of the two main tracheal trunks in the base of the abdomen

to form air sacs, the presence of a sucking stomach as in the Lepidoptera, the constant number (four, rarely five) of the Malphigian tubes, and the absence of a *bursa copulatrix* in the females.

The alimentary canal presents behind the œsophagus an expansion which is a crop or sucking stomach. The ventriculus, or true stomach, lying behind it, has usually two cœca; and the long, slender, Malpighian vessels are, in almost all species, four in number, a surprising constancy compared with the condition in other groups of specialized insects. The vessels open singly into the alimentary canal in some flies and in others they unite in pairs before reaching the canal and open into it by two ducts.

The heart is of the usual type, with two chambers in the more specialized families, owing to the concentration of the body. In the larva of *Corethra* the heart is a simple, elongate tube without chambers.

The two main tracheal trunks expand at the base of the abdomen into conspicuous air sacs similar to those found among Hymenoptera, Lepidoptera, the lamellicorn beetles and some other insects. The two pairs of spiracles of the thorax are provided with "vocal cords", and a considerable part of the humming sound is produced by these structures. The abdominal spiracles of some flies are as primitive as are to be found among insects, being simply unlipped openings.

The condition of the nervous system varies greatly within the order. In the elongate, more generalized Nematocerous forms there are five or six abdominal ganglia, and three distinct thoracic ganglia. From this condition to that shown by the Muscidæ, where all the thoracic and abdominal ganglia are united into one large ganglion in the thorax, a most instructive series of gradatory forms is presented. In the Empididæ, which stand intermediately as regards the concentration of the ventral cord, the two anterior thoracic ganglia are fused into one; this condition is radically different from

that shown by insects of other orders, as the Coleoptera, Lepidoptera and Hymenoptera, which have but two thoracic ganglia. In these insects, however, it is the two posterior ganglia (meso and metathoracic) which are fused into one.

The careful studies of Child on the so-called Johnston's organ, an elaborate structure of fine chitin rods connected with special nerve cells and these connected by fine nerves with the main antennal nerve, the whole organ (which is located in the second antennal joint) seem to ascribe definitely an auditory function to the antennæ. Child's studies were mostly made on the Nematocerous forms.

Special nerve structures are present at the base of the halteres, and orienting, auditory and other sense functions have been ascribed to them by various morphologists. Flies from which these organs have been removed are utterly unable properly to direct their flight.

The internal organs of the reproductive system present some interesting peculiarities. The ovaries of the female consists of an exceptionally large number of egg-tubes, there are three *receptaculi seminales*, paired accessory glands, and no true *bursa copulatrix*. The males have two oval testes with short vasa differentia. The testes are not infrequently colored, possessing a pigment layer. There is a well developed penis with accessory copulatory organs.

Classification of Diptera.

The first real attempt at the subdivision of the order of Diptera was made by Latreille in 1802, when he distinguished between the Nematocerous and Brachycerous forms. The term Nemocera was introduced by him in 1817, and the characters upon which he based the group are yet employed. The name Brachycera was applied to the remaining diptera by Macquart in 1825. The characters he used, following Latreille, were:

Antennæ at least six-jointed; palpi four or five-jointed.	Nemocera.
Antennæ three-jointed; palpi one or two-jointed.	Brachycera.

This attempt at subdivision, based upon the antennæ and palpi, was all that had been made until a comparatively recent date. It is the classification followed by Loew in the first volume of the Monographs published as late as 1860. In 1863 Brauer proposed a more rational division of the diptera into the two suborders, Orthorrhapha and Cyclorrhapha, based chiefly upon larval and pupal characters. Their characters in a later publication he gives as follows:

Larvæ with a "jaw-capsule" (Kieferkapsel) or a differentiated head. Pupæ free or enclosed in the larval skin; in either case the larval skin bursts for the extrication of the pupa or imago in a T-shaped opening on the back of the anterior end, or rarely in a transverse rent between the eighth and ninth abdominal rings. The imago lacks the frontal lunule and ptilinum. . . . . ORTHORRHAPHA.

Larvæ without differentiated head. Pupæ always enclosed in the hardened larval skin (forming the so-called puparium); the imago always escaping from the anterior end through a circular orifice. Frontal lunule present; ptilinum usually present. . . . . CYCLORRHAPHA.

More recently Brauer has proposed a further subdivision of the suborders into tribes and groups as follows:

SUBORDER ORTHORRHAPHA.

Section I. Nematocera.
- Tribe 1. Eucephala. Families Mycetophilidæ, Bibionidæ, Chironomidæ, Culicidæ, Blepharoceridæ, Simuliidæ, Psychodidæ, Ptychopteridæ, Rhophidæ.
- Tribe 2. Oligoneura. Family Cecidomyidæ.
- Tribe 3. Polyneura. Tipulidæ, Limnobiidæ.

Section II. Brachycera.
- Tribe 4. Acroptera. Family Lonchopteridæ.
- Tribe 5. Platygenya.
  - Group 1. Homodactyla.
    - Superfamily 1. Notacantha. Families Stratomyidæ, Xylophagidæ.
    - Superfamily 2. Tanystoma. Families Tabanidæ, Acanthromeridæ, Leptidæ.
    - Superfamily 3. Bombylimorpha. Families Nemistrinidæ, Acroceridæ.

Group 2. Heterodactyla.
Superfamily 1. Procephala. Families Mydaidæ, Asilidæ, Bombyliidæ.
Tribe 6. Orthogenya. Families Empididæ, Dolichopodidæ.

SUBORDER CYCLORRHAPHA.

Section I. Aschiza.
Tribe 1. Syrphidæ. Families Syrphidæ, Pipunculidæ.
Tribe 2. Hypocera. Families Phoridæ, Platypezidæ.
Section II. Schizophora.
Tribe 3. Eumyidæ. Muscidea of the present work.
Superfamily Schizometopa. Calyptratæ of the present work.
Superfamily Holometopa. Acalyptratæ of the present work.
Tribe 4. Pupipara. Pupipara of authors.

Osten Sacken, however, objects to this classification and offers valid reason to sustain his objections, at least so far as the Orthorrhapha are concerned. He insists that the Nematocera and Brachycera are natural divisions and bases their distinction ultimately upon the palpal characters. He says that for some unexplained reason later authors have neglected these characters and have concentrated their attention upon the antennæ. In this statement, however, I think that Osten Sacken is somewhat unjust. The characters of the palpi have been used by both Schiner and Brauer, as well as in my own classification, and stress has been placed upon them. Schiner states explicitly that *Nemistrina* has three-jointed palpi, and it is known that *Aëdes*, as well as some genera of Cecidomyidæ, have but a single palpal joint. This being the case, it is seen that the character of the palpi is *not* the ultimate distinction between the two groups. As I have already said, there are never more than four articulated joints among the diptera in the palpi, and the great majority of the Cyclorrhapha have none, the basal process or projection being all that is present, and this will usually if not always be found, albeit often in a rudiment condition, among all forms of the order.

I give Osten Sacken's classification at length, as follows:

ORTHORRHAPHA.

Nemocera vera. No holoptic head in the male sex; no bisection or bicoloration of the eyes. Antennæ provided with sensitive hairs arranged symmetrically on the flagellum in verticils or pencils of hairs (exception Mycetophilidæ). No ocelli (exception Mycetophilidæ and Lestreminæ). No pulvilli; empodia often but not always present.

A. Larvæ peripneustic*, always terrestrial. Families Cecidomyidæ, Mycetophilidæ.

B. Larvæ metapneustic or amphipneustic, aquatic, subaquatic, sometimes terrestrial. Families, Culicidæ, Chironomidæ, Psychodidæ, (?) Dixidæ, Tipulidæ.

Nemocera anomala. Diptera with homologous joints to the flagellum, usually four-jointed palpi. Males frequently holoptic, sometimes the females also. Pulvilli usually present. Antennæ without sensitive hairs. Ocelli usually present. Families Bibionidæ, Simuliidæ, Blepharoceridæ, Rhyphidæ, Orphnephilidæ.

Brachycera. Palpi one or two-jointed, not pendulous, porrect, the second joint more or less clavate, larger than the first. Joints of the flagellum usually not homologous.

No macrochætæ. Three well developed pulvilli. Males predominently holoptic, the eyes often bisected. Antennal flagellum polymorphous. Axillary incision, alula and antitegula in most cases distinctly developed. Discal cell usually present; usually five posterior cells. Legs rather smooth. Families Stratiomyidæ, Tabanidæ, Acanthomeridæ, Leptidæ. . . . . EREMOCHÆTA.

COLLECTION AND PRESERVATION OF DIPTERA.

Flies must be collected with much more care than can be safely used with such insects as coleoptera. Moisture of all kinds injures or ruins them, and specimens collected in alcohol are worthless. For this reason the collecting bottle should be lined throughout with blotting paper, and the cyanide placed in the cork; a very little poison suffices to kill them. Nor should they be allowed to become too dry before pinning. The pin should be thrust through the middle of the thorax, and the specimen placed just so as to enable the head of the pin to be grasped by the thumb and finger safely. Very small

* *Amphipneustic* larvæ are those in which the spiracles are confined to the first and last segments; *metapneustic* those in which they are confined to the posterior segments; *peripneustic* those in which they are absent on the median rings.

specimens should never be glued to card points, as is commonly done with coleoptera; they should always be pinned. Sometimes specimens may be collected and packed in some very fine, light sawdust, impregnated with carbolic acid, where it is inconvenient or impossible to pin them. Such specimens being gently separated from the sawdust are allowed to remain for some hours, over, but not touching, damp sand before pinning. To pin the small specimens, use narrow strips of good card-board or bristol-board, thrusting a slender pin through one end and allowing it to protrude just a little above the edge and clipping off the longer end with a pair of pliers. Thrust the point of the pin as held in the card-board, into the under side of the insect, but not entirely through it, and a stronger pin in the reverse direction through the other end of the small strip. The pins are to be thrust through the card-board from edge to edge, and in consequence a good quality is to be selected that will not split too readily. The wings should never be spread, but should be turned aside so as not to conceal the abdomen. In the early part of the season many interesting species will be caught with the beating-net. The pointed end of the beating-net may be thrust, with its contents, into a bottle containing a little chloroform, or into a cyanide bottle, for a short time, when the specimens may be leisurely removed. Later in the season, flower-flies will be collected from a great variety of melliferous blossoms, and it is better to wait for the specimens to come to such blossoms than to go hastily about looking for them. I have collected from a single patch of elderberry blossoms, not a rod in diameter, more than forty species of Syrphidæ within ten days. Not many species are to be found in shady woods, but those species must be sought for there. To preserve flies in the cabinet from their insect enemies, I use naphthaline. The head of ordinary pins, when heated red-hot, may be thrust into the common moth-balls sold by the druggists, which when thus mounted serve all purposes.

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NORTH AMERICAN DIPTERA.

TABLE OF THE FAMILIES OF DIPTERA.

1. Flies of a leathery or horny structure, living parasitically in the adult state upon warm-blooded vertebrates; head small, either closely united to the emarginate anterior part of the thorax or folding back into a groove upon the dorsum; mouth-part incomplete, the palpi wanting; legs separated by the broad sternum; abdomen indistinctly segmentated; claws well developed. *Pupipara.* . . . 43

   Flies of softer structure, never living parasitically in the adult state upon vertebrates; head separated from the thorax by a free neck. 2

2. Antennæ many-jointed, often longer than the thorax, the two basal joints, only, differentiated, the remaining joints usually distinct; palpi composed of three or four joints, usually elongate; anal cell rarely closed or narrowed in the margin. *Nematocera.* . 3

   Antennæ rarely as long as the thorax, composed primarily of three joints, the third of which may be simple or complex (that is composed of more or less distinct annuli or segments,)* with or without a terminal or dorsal arista or terminal style; anal cell closed before the border, or, distinctly narrowed in the border, or, if of other structure, the antennæ composed of three simple joints with or without an arista or style; palpi rarely much elongate, composed of from one to three joints, or rudimentary. 14

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* To the beginner there will be several families here which will cause doubt; they are especially the *Simulidæ*, *Bibionidæ*, *Orphnephilidæ*, and some of the *Xylophaginæ*. The *Simulidæ* are small, thick-set flies, with the antennæ not longer than the head, composed of ten joints, the veins of the wings weak and the neuration incomplete. In the *Bibionidæ* the antennæ have from nine to thirteen joints closely united, altogether no longer than the thorax; there is no discal cell. *Orphnephila* is composed of species not more than three or four millimeters in length; the antennæ are apparently three-jointed with a terminal arista; under close examination, however, the third joint will be found to be composed of three segments and the arista of seven. The *Xylophaginæ* will be best distinguished by the complete neuration and the closed or narrowed anal cell. In all cases where the palpi are found to be composed of four joints the species may be unhesitatingly placed among the *Nematocera*.

3. Dorsum of thorax with a complete, V-shaped suture;* wings (wanting rarely) many-veined, often with a complete discal cell; ocelli wanting (present in a few forms); often large flies. . . TIPULIDÆ.
   Dorsum of thorax without a V-shaped suture, or rarely with any transverse suture. 4

4. A complete discal cell present; empodia developed pulvilliform, the pulvilli rudimentary. . . . . RHYPHIDÆ.
   No discal cell. 5

5. Antennæ composed apparently of three joints with a terminal arista; small species, three or four millimeters in length. ORPHNEPHILIDÆ.
   Antennæ not apparently composed of three joints and a terminal arista. 6

6. Wings with only a few longitudinal veins, and no cross-veins; coxæ not elongate, tibiæ without terminal spurs, legs not thickened; ocelli present or absent; small or minute, delicate, mostly gall-producing flies. . . . . CECIDOMYIDÆ.
   Not such flies; wings usually many-veined. 7

7. Ocelli present. 8
   Ocelli wanting (compare *Mycetophilidæ*). 10

8. Wings broad, bare, characteristically marked by numerous folds between the veins, giving a netted, spiderweb-like appearance. LIPONEURIDÆ.
   Wings not so marked; no entire transverse suture. . . . 9

9. Coxæ much elongated (moderately so in *Sciarinæ*); antennæ often elongate, the joints constricted; three or two ocelli present (in the latter case one situated near each eye and often perceptible with difficulty); all the tibiæ with spurs. . . . . MYCETOPHILIDÆ.
   Coxæ short, the thorax rounded, not humped above; antennæ shorter than the thorax, thickened, the joints closely united without marked constrictions; legs strong, the front femora often thickened; empodia pulvilliform, the pulvilli sometimes absent; eyes of ♂ large. BIBIONIDÆ.

10. The costal or marginal vein does not extend beyond the tip of the wing. 11
    The marginal vein encompasses the entire wing. . . . 12

11. Antennæ slender, the joints more or less constricted, and often bushy plumose; legs slender, hind tibiæ and metatarsi never dilated; abdomen slender; wings narrow. . . . . CHIRONOMIDÆ.

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* *Bittacomorpha*, *Ptychoptera* and *Idioplasta* may cause doubt here. They have the suture incompletely V-shaped and sinuous. Compare *Rhyphidæ*.

Antennæ shorter than the thorax, the joints broadly and closely united, without marked constriction, and never hairy or pilose; legs strong, hind pair more or less dilated; body thick-set, abdomen ovate; wings broad, bare, the anterior veins stouter, the posterior weak. Black-flies, Buffalo-gnats. . . . . SIMULIIDÆ.

12. Wings ovate, distally with ten longitudinal veins and without cross-veins; veins strongly hairy; tibiæ without terminal spurs; small, lepidopter-like flies, the wings when at rest folded roof-shaped. PSYCHODIDÆ.

Wings with cross-veins near the middle. 13

13. Wings hairy, fringed on the hind margin; mosquitoes. CULICIDÆ.

Wings bare; the second vein arises near the middle of the wing. DIXIIDÆ.

14. Third joint of the antennæ complex; basal cells of wing long. . 15

Antennæ composed of three simple joints, the third not annulated or segmentated, with or without a dorsal arista or terminal style or arista. 18

15. Empodia undeveloped or bristle-like; antennæ elongate, composed of four or five joints, without differentiated style or arista; vertex and front hollowed out transversely between the eyes; eyes of male never contiguous. 25

Empodia developed pulvilliform; third antennal joint more or less distinctly segmentated or annulated; body not bristly. . . 16

16. Tegulæ rather large; third longitudinal vein furcate; five posterior cells always present; the costal vein encompasses the whole margin of the wing; proboscis of the female adapted for piercing; third joint of the antennæ with from three to eight annuli, never with style or bristle. Horseflies. . . . . TABANIDÆ.

Tegulæ small or rudimentary; mostly flower-flies. 17

17. Tibiæ wholly without spurs; longitudinal veins of the wings usually crowded anteriorly,* the posterior ones often weak; the costal vein does not reach beyond the tip of the wing; antennæ long or short, with or without a terminal or dorsal arista or terminal style. STRATIOMYIDÆ.

The middle tibiæ, at least, with distinct spurs; the costal vein encompasses the entire wing; third longitudinal vein always furcate and five posterior cells always present. . . . LEPTIDÆ.

18. Antennæ apparently single-jointed, with a long bristle; wings with several stout veins anteriorly, and other weaker ones apparently connected with them; femora flattened, the hind legs long: antennæ situated near the mouth; small, quick-running, hunchbacked flies. PHORIDÆ.

Not such flies. 19

* If very large flies from Central America, compare ACANTHOMERIDÆ.

19. Empodia developed pulvilliform, that is three nearly equal membranous appendages on the under side of the claws. 20
Empodia wanting, rudimentary or linear, never developed like the pulvilli. 22

20. Tegulæ very large; thorax and abdomen inflated; head small, eyes large; neuration varied. . . . . ACROCERIDÆ.
Tegulæ of moderate size or rudimentary. 21

21. Middle tibiæ at least with spurs; no bristles on femora or tibiæ; third longitudinal vein fureate; five posterior cells present (four in *Dialysis*); anterior cross-vein always distinct; third joint of the antennæ with a bristle or slender style, usually terminal. LEPTIDÆ.
Not such flies. 22

22. Third longitudinal vein of the wings not fureate. . . . 31
Third longitudinal vein furcate, two or more submarginal cells present. 23

23. Arista or style of antennæ when present always terminal. . . 24
Arista dorsal, always present. 36

24. Vertex and front distinctly hollowed out between the eyes; eyes of male never contiguous; basal cells large; mostly large flies. . 25
Front and vertex plane or convex. 26

25. Proboscis with fleshy labella at the tip; neuration complicated, the fourth vein at least curves forward to terminate before the tip of the wing; palpi rudimentary or wanting. . . . . MYDAIDÆ.
Proboscis without fleshy labella at tip, the under part forming a horny sheath; five posterior cells always present; palpi usually prominent. ASILIDÆ.

26. Five posterior cells in the wing; basal cells large. . . . 29
Never more than four posterior cells in the wing. . . . 27

27. Third antennal joint without bristle or style; three posterior cells; first posterior cell narrowed or closed, the fourth longitudinal vein terminating at or before the tip of the wing. . . SCENOPINIDÆ.
Third antennal joint usually with terminal style; four or three posterior cells; the fourth vein terminates beyond the tip of the wing. 28

28. Anal cell narrowly open, or closed near the margin; discal cell present. . . . . BOMBYLIIDÆ.
Anal cell closed remote from the border, sometimes wanting; if closed near the border (*Hilarimorpha*), the discal cell wanting. EMPIDÆ.

29. Neuration intricate, the anterior cross-vein wanting or rudimentary, owing to the coalescence of the third and fourth veins for a longer or shorter distance; tibiæ without terminal spurs; empodia and pulvilli membranous, but frequently minute. . . NEMESTRINIDÆ.

Neuration not intricate; anterior cross-vein always distinct; labella of proboscis fleshy. 30

30. The fourth vein terminates before the tip of the wing; male sexual organs prominent. . . . . APIOCERIDÆ.
The fourth vein terminates beyond the tip of the wing; male sexual organs small. . . . . THEREVIDÆ.

31. Antennæ with a dorsal arista. 37
Antennæ with a terminal arista or style. 32

32. Wings pointed, no cross-veins in the middle, the fourth longitudinal vein furcate and arising from the fifth; small species. LONCHOPTERIDÆ.
Wings rounded at the tip, not lancet-like. 33

33. Second basal cell confluent with the discal cell, not separated by a vein, the auxiliary vein does not terminate in the costa; small, mostly brilliant-colored, predaceous flies. . . . DOLICHOPIDÆ.
Second basal cell separated from the discal cell by a vein. . 34

34. Antennæ with a terminal style. 35
Antennæ with a terminal bristle. 36

35. First posterior cell closed (*Conopidæ* pt., *Syrphidæ*, pt.) . . 40
First posterior cell open. . . . . EMPIDÆ.

36. Head comparatively small, the proboscis more or less elongated; alula of wings usually rudimentary. . . . . EMPIDÆ.
Head as broad as the thorax; proboscis fleshy; alula distinct. PLATYPEZIDÆ.

37. Proboscis rudimentary, palpi wanting; first posterior cell usually narrowed; tegulæ usually large. Botflies. . . . ŒSTRIDÆ.
Proboscis not rudimentary; palpi present. 38

38. Second basal cell confluent with the discal cell, not separated by a small vein; small, mostly brilliant-colored, predaceous flies; face never broad and convex. . . . . DOLICHOPIDÆ.
Second basal cell separated from the discal cell by a small cross-vein (if not, not brilliant-colored predaceous flies). . . . 39

39. Basal cells of wing elongate, the anal cell closed toward the margin; first posterior cell closed or much narrowed (except sometimes in *Pipunculidæ*). 40
Posterior basal cell small, the anal cell always closed remote from the margin. 42

40. Face with subantennal vertical grooves or depression. . . 42
Face convex transversely or with a median ridge; never with a subantennal depression. 41

41. Between the third and fourth longitudinal veins and sub-parallel with them, crossing the anterior cross-vein, a spurious longitudinal vein, or, when rarely not present, the first posterior cell closed a considerable distance from the border. . . . . SYRPHIDÆ.

Spurious vein never present; first posterior cell not closed before the margin; eyes very large; small species. . . PIPUNCULIDÆ.

42. Proboscis horny and elongate, often folding back near the middle; abdomen never with bristles; tibiæ without terminal spurs or if with spurs, the face with a median ridge, and the proboscis folding; first posterior cell closed or narrowed. . . . . CONOPIDÆ.

Proboscis fleshy and not elongate; if elongate and slender, with or without a median hinge, the body with distinct bristles, or the bristle of the antennæ plumose. . . . . MUSCIDÆ *sens. lat.*

43. Wingless flies, parasitic upon bats; head not flattened, folding back upon the dorsum of the thorax; first joint of tarsi not abbreviated. NYCTERIBIDÆ.

Winged or wingless flies, parasitic upon birds or mammals; head flattened, sunk into a shallow emargination of the thorax; first joint of the four anterior or of all the tarsi abbreviated. . HIPPOBOSCIDÆ.

ORTHORRHAPHA.

1. CECIDOMYIDÆ.

Small, slender flies with broad wings, and long antennæ and feet. Head small; eyes round or reniform, sometimes holoptic; ocelli usually wanting; antennæ long, cylindrical or bead-like, composed of a large number of joints—ten to thirty-six; in many species the joints beaded or petiolate and verticillate, especially in the ♂; proboscis short, elongated in one genus only; palpi usually with four joints. Thorax ovate; more or less convex, without transverse suture; abdomen composed of eight segments; hypopygium composed of a pair of projecting hooklets; ovipositor sometimes much elongated. Legs long and slender; coxæ not very long; tibiæ without terminal spurs; the first joint of tarsi sometimes very short. Wings large, usually hairy, narrowed at the root, without alula; at the most with five, usually with but three, longitudinal veins, viz: the first, the third, and the fifth; the fourth and the sixth sometimes present; the humeral cross-vein indistinct, or wanting; costal vein enclosing the entire wing; veins all weak; the fifth usually furcate; anterior cross-vein very near the root of the wing, often appearing as the beginning of the third vein, the real origin of the third vein having the appearance of a short cross-vein; only one basal cell present.

The family Cecidomyidæ includes a very large number of frail, delicate, often very minute flies, but is of the greatest interest to the biologist as well as the economic entomologist. At present about 600 or 700 species are known.

The egg of the Cecidomyidæ is somewhat elongated, rounded at both ends, orange yellow or white in color. The time required for hatching is very variable and depends upon the weather, sometimes requiring a very few hours, but more generally a few days or even weeks. The larval food is almost

wholly vegetable. The larvæ of some species have been bred from decaying wood and bulbs, others from under the bark of trees, or from fungi. But the great majority prefer living plants, attacking the soft and green parts. Most of the larvæ are monophagous, living almost exclusively on a single kind of plant, or at least closely allied plants; but there are certain exceptions, such as *C. sisymbrii,* which is said to form the gall in spring on the barberry, and later in the season on a nasturtium. There are certain others which are inquilinous, that is guests or parasites in galls formed by other Cecidomyids. Finally, some live parasitically in the society of plant lice. Not a few, such as the Hessian fly, live upon the surface of plants, or in the axils of their leaves; but the greater number penetrate inside the plant, producing the so-called galls. Every part of the plant from the root to the flower and the fruit is liable to such attacks. With a few rare exceptions, each species attacks the same part of the plant and deforms it in the same manner. The galls cause deformations and excrescences attached to the stalks, stems, or flowers, destroying the plant-tissue. When first hatched the larvæ are colorless and translucent, with the alimentary canal showing through the skin greenish. Later in life they assume different shades of red or yellow. They have the extraordinary number of fourteen segments, thus forming an apparent exception to the larvæ of all other insects, which, as a general rule, have thirteen. The supernumerary segment is placed between the head and first thoracic segment. The larvæ have nine pairs of stigmata along the sides of the body apparent as more or less nipple-shaped projections. The head is not differentiated; the jaws are rudimentary and there are large two-jointed palpi or antennæ. The last abdominal segment is smooth and rounded, sometimes with tubercles or a pair of horny processes which are said to be used by the larvæ in leaping. On the under side of the body at the junction of the first thoracic with the supernumerary segment there is a horny, more or less elon-

gated appendage whose use or homology is unknown. It varies in shape in different species, the free end sometimes terminating in two joints, sometimes in one, sometimes toothed and serrated. This organ, discovered by von Baer, has been called by Osten Sacken the "breast bone"; in England it is known as the "anchor process". By some it is thought to be a pseudopod; by others the mentum; and Miss Ormerod believes its function is that of a scraper or digger in obtaining food from the stems. More probably its use is for locomotion, or for changing the position of the larva in its cocoon or case. The motions of the larvæ are usually slow, excepting those which live on the surface of leaves. Those which change their abode before assuming the pupa state become very active about the period of metamorphosis. A very great activity was observed by Winnertz in some such larvæ after a thunder storm. They left their hiding places under ground and crawled about restlessly for some time; repeating these actions after every thunder storm, some even two months after leaving their galls.

Owing to their rudimentary mouth-parts it seems evident that the larvæ must feed upon juices only, and that they need very little nourishment is shown by the fact that they attain their full growth and development in a gall just large enough to enclose them, apparently hermetically sealed and for the most part with hard walls. It is probable that they absorb nourishment in a quiescent state. As many as sixty individuals have been known to live in a single gall. What causes the galls is not easy to say; probably some peculiar irritation produced by the insect. It is probable that the larvæ of *Cecidomyia* do not undergo moultings like most dipterous larvæ. Before assuming the pupa state some larvæ leave their galls and conceal themselves under ground, in dry leaves and moss or under the bark of trees; while others, on the contrary, complete their transformation within the gall itself. The pupæ are generally, but not always, enclosed in the cocoon,

which Winnertz says is produced by an exudation or excretion from the larvæ and is not spun. Larvæ which had fastened themselves to the leaf were surrounded in twenty-four hours by a white halo of thread-like particles like spicules of crystals, the larvæ remaining almost wholly motionless. The cocoon is completed within a few days but even then shows no traces of the genuine web. There seems to be no doubt, however, but that they do in some cases actually spin a cocoon, as is so frequently the case among the fungus-gnats. The change to the pupa state is marked by an alteration of color, the anterior segments of the larvæ become distended, and the legs, wings, and antennæ developing and rapidly attaining their full pupal dimensions.

The period of pupation is very variable, depending upon warmth and moisture. The development is retarded by cold, though they are capable of withstanding a very low degree of temperature.

One of the most remarkable things in the biology of these or any other insects was discovered by Wagner in 1860. According to this scientist, the larvæ of certain species belonging to the genus *Miastor*, and which live under the bark of trees, produce from ovary-like organs a number of eggs which hatch within the abdominal cavity of the parent and there remain, feeding upon the abdominal tissues which surround them, until they are consumed. They then escape to increase in size and produce another generation in the same remarkable manner. These series of asexual reproductions are repeated until finally, from the last brood, pupæ are developed which undergo their transformation into imagines, and from which a new series of eggs, agamic broods of larvæ and pupæ in their turn result. There are other instances of pædogenetic reproduction among diptera, but none so interesting as this.

This family contains some of the most destructive of all insects in man's economy, and perhaps the most important of

these is *Cecidomyia* (*Oligotrophus*) *destructor*, commonly called the Hessian Fly, from the belief, probably erroneous, that it was first introduced into this country in straw brought by Hessian troops during the Revolution.

The fly is very small, but little more than an eighth of an inch in length, of a prevailing black color, with the abdomen pinkish or brownish. There are two broods, in spring and autumn. The female deposits her eggs, one or two at a time, on the upper side of the leaves of wheat, to the number of from eighty to a hundred, or even more. Hatching in from four to eight days, if the weather is favorable, the yellowish red larvæ crawl downward on the leaves until they insert themselves between the leaf and the stalk. Here they remain quiescent, growing by means of imbibition or absorption of the juices of the plant, until they reach the size of a small grain of rice. The larvæ that are hatched in April in a few weeks assume the pupa state, called the flax-seed stage. In August the second brood appears, the female of which deposits her eggs in young winter wheat or other grain, where the larvæ soon hatch and acquire the flax-seed condition in a few weeks, or by November, in which condition they pass the winter. In England there is but one brood, that of early summer, and the fly is not nearly so injurious to growing grain.

TABLE OF GENERA.

Fourth longitudinal vein wanting. . . . . CECIDOMYINÆ.
Fourth longitudinal vein present. . . . . LESTREMIINÆ.

CECIDOMYINÆ.

1. Fifth longitudinal vein furcate, the first joint of the tarsi usually shorter than the following. 2
   Fifth longitudinal vein not furcate, the metatarsi longer than the following joint, the last two joints very small. 14
2. First and third longitudinal veins distinctly separated from each other and from the costa; costa not tomentose. 3
   First and third veins closely approximated to the costa and difficult to distingnish, the costa apparently thickened. 12

3. Antennæ bead-like, the joints verticillate. 4
Antennæ cylindrical, the joints approximated, not petiolate, and provided with short, close hair. 11

4. The third longitudinal vein terminates in the costa before the tip of the wing. . . . (*Dasyneura*) Cecidomyia Loew (non Meigen).
The third vein terminates at or beyond the tip of the wing. . 5

5. Thorax highly arched, hood-like, over the head. Hormomyia Loew.
Thorax only moderately arched; wings irridescent. . . . 6

6. Wings with but three longitudinal veins, the first, third and fifth. 7
Wings apparently with four longitudinal veins, the first, third and two in place of the fifth, the furcation taking place so near the root of the wing as to give the appearance of two longitudinal veins. 10

7. The anterior cross-vein, that is the vein arising at the root of the wing and connecting with the third nearly where it arises from the first, is curved *f*-shaped. 8
The anterior cross-vein is nearly straight, appearing as the beginning of the third vein. 9

8. Wings very long and narrow. . . . . Colpodia Winnertz.
Wings not more than three times as long as wide. Epidosis Loew.

9. Joints of the antennæ petiolate, in the male usually with two bead-like swellings on each joint.
(*Cecidomyia* Meigen non Loew) Diplosis Loew.
Joints not petiolated, or at the most the males with a single bead-like swelling on each joint. . . . . Dirhiza Loew.

10. Palpi large, with the last joint elongate; anterior cross-vein *f*-shaped. Asynapta Loew.
Palpi small, the last joint but little or not at all longer than the penultimate; anterior cross-vein but little curved. Winnertzia Rondani.

11. The third longitudinal vein terminates before the tip of the wing; fifth vein not furcate. . . . . Spaniocera Winnertz.
The third vein terminates at or beyond the tip of the wing; fifth vein furcate. . . . . Asphondylia Loew.

12. Proboscis much elongated, directed downward. Clinorhyncha Loew.
Proboscis short. 13

13. Metatarsi shorter than the following joint. . Lasioptera Meigen.
Metatarsi longer than the following joint. . Diomyza Stephens.

14. Wings with but two longitudinal veins, the first and fifth, the latter not furcate, and neither reaching beyond the middle of the wing. Heteropeza Winnertz.
Wings with three longitudinal veins, the first, third and fifth, the third reaching to the tip of the wing, the fifth not furcate. Miastor Meinert.

LESTREMINÆ.

1. Fourth longitudinal vein furcate. 3
   Fourth longitudinal vein not furcate. 2

2. Antennæ composed of from 11 to 25 joints, petiolate in the ♂.
   CAMPYLOMYZA Meigen.
   Antennæ composed of 11 (♂) or 8 (♀) joints, petiolate in neither sex.
   MICROMYIA Rondani.

3. Ocelli absent or indistinct. 4
   Ocelli distinct. 5

4. Antennæ 11-jointed in both sexes. . . . CECIDOGONA Loew.
   Antennæ 16-jointed in the ♂, 11 or 12-jointed in the ♀.
   LESTREMIA Macquart.

5. The anterior branch of the fourth longitudinal vein *f*-shaped, the posterior branch in a straight line with the prefurca. TRITOZYGA Loew.
   The anterior branch only lightly curved; antennæ of ♀ 10-jointed.
   CATOCHA Haliday.

2. MYCETOPHILIDÆ.

Mostly small, delicate, slender flies, with more or less elongated coxæ. Head small, rounded or somewhat elongate. Eyes round, somewhat prominent; ocelli two or three in number, when only two, placed one on each orbital margin; when three in number, placed transversely in the form of a shallow triangle. Front broad in both sexes. Antennæ elongated, curved, twelve to sixteen jointed, the two basal joints differentiated, the remainder cylindrical, flattened or petiolated. Proboscis rarely elongated; palpi three or four jointed, usually inflected, the first joint small. Thorax more or less, sometimes highly arched, without transverse suture; metanotum large; scutellum small. Abdomen elongated, composed of six or seven segments, cylindrical or compressed, sometimes narrowed at the base; male genitalia projecting forceps-like; ovipositor pointed, usually with two terminal lamellæ. Legs more or less elongated, the coxæ more or less, sometimes much elongated; femora more or less dilated, tibiæ with spurs. Wings large (wanting in the ♂ of *Epidapus*); auxiliary vein present, though sometimes rudimentary; second longitudinal

vein wanting; the third vein arises from the first usually at such an angle that its first section (to the anterior cross-vein) has the appearance of a cross-vein; fourth vein always, the third and fifth either furcate or not; sixth vein never furcate, sometimes rudimentary; seventh vein usually short, often rudimentary or entirely wanting; discal and posterior basal cells always wanting.

The family Mycetophilidæ, commonly known as fungus-gnats, comprises seven or eight hundred known species of small or minute flies, the best known of which are, perhaps, the various dark-winged species of *Sciara* so common about gardens. In the following description of the immature stages I draw largely from Osten Sacken.

The larvæ have a distinct horny head; horny, flat, lamelliform mandibles; maxillæ with a large coriaceous inner lobe and a horny outside piece, with a circular excision at the tip, the labium small, horny, almost rudimentary; the antennæ are usually small or rudimentary, the ocelli are either wanting or seen in a small pellucid spot below each antennæ. The body is subcylindrical, more or less elongated, fleshy, whitish or yellowish, and composed of twelve segments. It is smooth, without hairs or bristles, except those on the ventral side. It is generally transparent, showing distinctly the intestinal canal and the trachea. There are eight pairs of stigmata, one on the first segment, and seven on the first seven abdominal segments, the last two having none. The locomotory organs consist of more or less apparent transverse swellings on the under side of the ventral segments, sometimes furnished with minute bristles or spines.

The larvæ present some of the most singular habits among all diptera. They are gregarious, and live in or upon decaying matter. Most of the species seem to prefer fungus or fungoid substances, whence comes the common name of fungus-gnats applied to the mature insect. The larvæ of *Sciara* are found among decaying leaves, in vegetable mold, in cow-dung, under

the bark of dead trees, etc. The larvæ are said to moult several times before pupating. The larvæ of many species spin delicate webs over the surface of fungi, and on this web they live until ready to pupate, when they spin a dense cocoon in sheltered spots; others live within the decaying fungi. Perhaps the most singular habits of all are those of species of *Sciara*, which are even more gregarious than other members of this family. They have the singular propensity of sticking together in dense patches, and will form processions sometimes twelve or fourteen feet in length, and two or three inches broad. The phenomenon has been observed frequently both in Europe and America, but the reason therefor is not yet well understood, though the object of the migration seems to be the search for better feeding grounds. Because of this habit, the name of "army worm" has been given to them. Yet more singular is the phosphorescent character of the larvæ of some species. The larvæ, probably of *Sciophila*, were observed by Hudson to be so luminous that "the light of a single individual kept in a caterpillar cage may be seen streaming out of the ventilators at a distance of several feet."

The pupæ of Mycetophilidæ are free,—that is they are not contained within the larval skin, as is so commonly the case with diptera. They are usually smooth, with the legs applied to the breast and venter, the antennæ bent around the eyes, and their remaining portion applied to the breast between the wings and the legs. The pupæ of not a few are enclosed in a cocoon of more or less density, spun by the larvæ; others enclose themselves in earthy cases.

The study of the mature insect requires some care. Usually a compound microscope is necessary for the detection of many characters, especially of the more minute species, and generally, when there is doubt of the identity, it is best to mount the whole insect or the more important parts under a cover glass.

In America, as elsewhere, but little study has been given to

this family, and, hence there are doubtless not a few genera that have hitherto escaped detection. The following table has been mostly compiled from V. d. Wulp, Winnertz and Schiner, and compared with representatives of most of the genera.

Epidapus scabies has recently been shown by Hopkins to be a cause of the potato scab. Various species of *Sciara* have also been bred from potatoes and other vegetables. The larvæ of *Sciara mali* "destroy the interior of apples by burrowing through them, while the fair exterior shows no indication of concealed attack." The larvæ of a species of *Exechia* have been found by Lintner very destructive to mushrooms.

TABLE OF GENERA.

1. Coxæ moderately long; anterior cross-vein in the same right line with the second section of the third vein; fureation of the fifth and sixth veins near the base of the wing. . . . . SCIARINÆ.

   Coxæ much elongated; anterior cross-vein not in the same right line with the second section of the third vein. 2

2. Origin of the fourth vein near the base of the wing; seventh vein more or less incomplete. 3

   Origin of the fourth vein at or near the middle of the wing; seventh vein usually complete. 4

3. Third longitudinal vein fureate, the anterior branch usually so near the origin and so transverse in position that it resembles a supernumerary cross-vein; three ocelli present . . . SCIOPHILINÆ.

   Third longitudinal vein not fureate; two or three ocelli present. MYCETOPHILINÆ.

4. Anterior branch of the third vein very long, terminating in the costa and arising very close to or at the beginning of the second section of the third vein. . . . . MYCETOBIINÆ.

   Anterior branch of the third vein short, more transverse, usually ending in the first vein. 5

5. The prefurca of the fourth vein arises from the third vein beyond the apparent cross-vein, i. e. the cross-vein is really wanting and the third and fourth veins are coalescent for a short distance. . 6

   The fourth vein continues in the same line before the cross-vein to its origin from the fifth. . (*Bolitophilinæ*) BOLITOPHILA Meigen.

6. Antennæ short and thick-set, often flattened. . . CEROPLATINÆ.

   Antennæ long and slender, longer than the body. (*Macrocerinæ*) MACROCERA Meigen.

SCIARINÆ.

1. Wings and halteres wholly wanting. . . EPIDAPUS ♀ Haliday.
Wings and halteres as usual. 2

2. The fourth vein springs from the third at the angle, i. e. the anterior cross-vein is obsolete. . . . . EPIDAPUS ♂.
Anterior cross-vein not obsolete. 3

3. Antennal joints of the male pedicillated and with whorls of hairs. ZYGONEURA Meigen.
Antennal joints not pedicillated; bare or with short hairs. . . 4

4. Wings very distinctly hairy. . . . . TRICHOSIA Winnertz.
Wings bare or but slightly hairy. . . . . SCIARA Meigen.

MYCETOBINÆ.

1. Auxiliary vein complete; the anterior branch of the third vein arises at the point where the third vein and the anterior cross-vein unite. MYCETOBIA Meigen.
Auxiliary vein rudimentary, not terminating in the costa; the fork of the third vein petiolate. 2

2. Fork of the third vein shorter than the fork of the fourth vein. PLESIASTINA Winnertz.
Fork of the third vein longer than that of the fourth. DITOMYIA Winnertz.

CEROPLATINÆ.

1. Face and proboscis prolonged, snout-like. . ASINDULUM Latreille.
Face and proboscis not produced. 2

2. Antennæ shorter than the head and thorax, flattened; palpi short. CEROPLATUS Bosc.
Antennæ usually more elongate, cylindrical; palpi moderately long. PLATYURA Meigen.

SCIOPHILINÆ.

1. Anterior cross-vein more than twice the length of the first section of the third vein, forming apparently the beginning of the third vein. TETRAGONEURA Winnertz.
Anterior cross-vein but little longer or shorter than the first section of the third vein, and forming a distinct angle with the second section. 2

2. The costal vein terminates at the tip of the third vein. SCIOPHILA Meigen
The costal vein continues a short distance beyond the end of the third vein. 3

3. Fork of the fourth vein very short petiolate, the prefurca shorter than the anterior cross-vein. 4
Prefurca of the fourth vein much longer than the anterior cross-vein. 5

4. Fifth vein furcate. . . . . Lasiosoma Winnertz.
   Fifth vein not furcate. . . . . Stægeria V. d. Wulp.
5. Proximal end of the posterior fork (fifth vein) before or opposite the anterior cross-vein. . . . Neoempheria Osten Sacken.
   Proximal end of the posterior fork beyond the anterior cross-vein. Polylepta Winnertz.

MYCETOPHILINÆ.

1. Three ocelli present. 3
   Only two ocelli, one situated near the margin of each eye. . . 2
2. The costal vein is continued beyond the tip of the third vein. Eudicrana Loew.
   The costal vein reaches only to the tip of the third vein. Mycetophila Meigen.
3. The costal vein is continued beyond the tip of the third vein. . 4
   The costal vein reaches only to the tip of the third vein. . . 11
4. Fifth longitudinal vein not furcate, the fourth furcate. Acnemia Winnertz.
   Fifth vein furcate. 5
5. Furcation of the fifth vein before or opposite the furcation of the fourth. 6
   Furcation of the fifth vein distinctly more distal than that of the fourth. Phthinia Winnertz.
6. Proboscis elongate. . . . . Gnoriste Meigen.
   Proboscis not elongate. 7
7. Auxiliary vein connected with the first longitudinal vein by a cross-vein. 8
   Auxiliary vein not connected with the first vein by a cross-vein. . 9
8. Ocelli of nearly equal size; the auxiliary vein terminates in the cross-vein connecting it with the first longitudinal. Syntemna Winnertz.
   Ocelli of unequal size; the auxiliary continuous beyond the cross-vein, terminating in the costa. . . . . Boletina Staeger.
9. First basal cell very long, reaching beyond the middle of the wing; the beginning of the upper branch of the forks obsolete. Leia Meigen.
   First basal cell of moderate length, not reaching the middle of the wing; forks complete. 10
10. Anterior forked cell acute proximally, the branches but little divergent. Epicypta Winnertz.
    Anterior forked cell less acute, the branches strongly divergent. Docosia Winnertz.
11. Fifth longitudinal vein forked. . . . Zygomyia Winnertz.
    Fifth vein not forked. 12

12. Auxiliary vein very long, terminating in the costa.
NEOGLAPHYROPTERA Osten Sacken.
Auxiliary vein short, or, if long, ending in the first vein. . . 13

13. Furcation of the fifth vein opposite or before the anterior cross-vein, and more proximal than that of the fourth vein. . . . 14
Furcation of the fifth vein more distal than the anterior cross-vein or the furcation of the fourth vein. 15

14. Auxiliary vein reaching beyond the middle of the first basal cell.
TRICHONTA Winnertz.
Auxiliary vein sometimes rudimentary, or not reaching to the middle of the first basal cell. 16

15. Furcation of the fourth vein opposite or before the first section of the third vein; posterior forked cell long and narrow.
RHYMOSIA Winnertz.
Furcation beyond the first section of the third vein. ALLODIA Winnertz.

16. Posterior forked cell narrow. . . . MYCOTHERA Winnertz.
Posterior forked cell broad, the branches divergent. EXECHIA Winnertz.

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3. LIPONEURIDÆ.

Moderate sized, elongate, bare species with broad wings and long legs. Both sexes holoptic or dichoptic; three ocelli present; proboscis elongated; antennæ slender, composed of from six to sixteen joints, clothed with short pubescence. Thorax with a distinct, broadly interrupted, transverse suture. Hypopygium projecting; ovipositor with two short, rather obtuse, lamella. Legs moderately slender, the hind pair much longer than the anterior ones. Empodium very small, almost rudimentary; pulvilli wanting; wings broad, bare, with a markedly projecting anal angle; peculiarly characterized from all other flies by a secondary, extremely fine, spider-like network.

The family Blepharoceridæ or Liponeuridæ was established by Loew in 1860 to include a half dozen species, which could not well be located in any of the existing families. Since that time the number in the family has been increased to about seventeen known forms, distributed in nine genera. Six of these species are found in Europe, one in Asia, six in North America, one in the West Indies, and three in South America. The

habits of only a few are known; one species, described by Fritz Muller, from South America is *said* to be dimorphic in the ♀, one form being sanguisugous, the other mellisugous. The larvæ live in running water. The head has a pair of slender antennæ; the cephalothorax and the following segments, each with a conical process bearing a bunch of bristles; pupa flattened, inactive and free, enclosed in a semioval, shell-like skin, the anterior end with horny erect breathing tubes. On the under side the skin is soft and transparent, and provided with three pairs of suckers by which the creature clings most firmly. The flies are found dancing in the spray of waterfalls, or resting upon the foliage near the margin of clear running brooks.

TABLE OF GENERA.

1. An incomplete longitudinal vein running into the posterior margin. 2.
   No incomplete vein running into the posterior margin; proboscis much elongated; hind tibiæ with spurs; claws simple; eyes entire, not bisected (♂). (Central and South America and West Indies.)
   PALTOSTOMA Schiner.

2. Second longitudinal vein furcate. 3
   Second longitudinal vein not furcate. 4

3. Origin of the anterior branch of the second vein coincident with the origin of the third vein; front tibiæ curved in ♂.
   BIBIOCEPHALA Osten Sacken.
   Origin of anterior branch of second vein more distal than the origin of the third vein; front tibiæ straight in the ♂. AGATHON Roeder.

4. Eyes holoptic, bisected by an unfaceted cross band or by a simple groove.
   BLEPHAROCERA Macquart.
   Eyes broadly dichoptic and not bisected. . . LIPONEURA Loew.

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4. CULICIDÆ.

Slender flies, characterized by the projecting proboscis and by the plumose antennæ of the male. Head small, round; eyes reniform; ocelli wanting. Antennæ thread-like, composed of fifteen joints; the first joint thick, the following joints small, round, and beset with whorls of hair, forming in

the male a long dense plumosity; last two joints slender and bare, or nearly so. Thorax ovate, arched, but not projecting over the head, without transverse suture; scutellum narrow; metanotum arched. Abdomen long and narrow, somewhat flattened, composed of eight segments; male genitalia prominent; ovipositor short. Legs long and slender; the coxæ not elongated; the tarsi long. Wings while at rest lying flat over the abdomen; long and narrow, with numerous veins; the hind margin fringed, and the costal vein encircles the entire wing; auxiliary vein distinct, terminating near the middle of the anterior border; second and fourth longitudinal veins furcate; third vein simple, arising beyond the middle of the wing; fifth vein simple; sixth and seventh reaching to the margin of the wing; anterior cross-vein situated beyond the middle of the wing, rectangular; two basal cells present, elongate.

The family Culicidæ, or mosquitoes, comprises nearly two hundred known species, distributed in all parts of the world. They will be best distinguished from the nearly related Chironomidæ by the elongate proboscis, and by the wings having a vein along the posterior border. The name mosquito is a Spanish and Portuguese diminutive of *Mosca*, and is sometimes applied to members of the Simuliidæ, but it is better restricted to this family.

The female mosquito deposits her eggs to the number of between two and three hundred in little boat-shaped masses on the surface of still water. The larvæ are hatched in a few days and escape from the lower end; here they grow rapidly, at times moving quickly, at other times resting quietly near the surface, breathing through the stigmatic tube at the tail, which tube has at its end a fringe of hairs that serves to close the opening when under water, and to suspend the larvæ from the surface while breathing. They are usually known as "wrigglers". The head in the larva is fully differentiated and usually has eyes; the jaws are thickly ciliated and fringed with hairs, by means of which a current of water is produced

that lumps little particles of food within reach of the[illegible]

After changing their skin two or three times they [illegible] a more club-shaped appearance, to which the parts of the [illegible] insect are indistinctly seen. The abdomen [illegible] head-like appendages that act as propellers; but [illegible] these pupæ remain near the surface, except when [illegible], and take no food. The breathing organs are no longer [illegible] at the tip, but there are now two that spring from the [illegible] the thoracic segments. Finally when the perfect insects [illegible] ready to emerge from the pupa, the back of the skin [illegible] has now come to the surface and is ruptured, splits and is [illegible] carefully and gradually extricates itself from the [illegible] which thus serves the place of a raft till the legs and [illegible] are sufficiently firm. But right now in the period of [illegible] pupa's life most fraught with danger; a warbler, a bird, [illegible] ant, or a ruinbug, hopelessly shipwrecks the frail [illegible]. [illegible] or wily running waters are free from these tyrants.

TABLE OF GENERA.

1. Proboscis short, not longer than the head; mentum[illegible] longer than broad, having joints [illegible]
   Proboscis much elongated, longer than the head and thorax united. 2
2. Proboscis strongly curved, palpi of the male very long, of [illegible] short [illegible]
   Proboscis straight [illegible]
3. Palpi in both sexes of equal length. [illegible]
   Palpi in the male long, about 4-jointed [illegible]
4. Palpi longer than the antennæ. [illegible]
   Palpi shorter than the antennæ [illegible]

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3. CHIRONOMIDÆ.

Gnatlike flies of slender form, the males sometimes [illegible] have plumose antennæ, seldom reaching ten millimeters in length. Head small, spheroidal, more or less covered by a projecting, hoodlike thorax. Antennæ threadlike or beadlike

with at less than six nor more than fifteen joints; in the male usually with a long dense plumosity; in the female with sparse hairs and sometimes with a smaller number of joints; the first joint short and thick. Eyes reniform or oval, usually naked or rudimentary; proboscis short; palpi four-jointed; the last usually elongated. Thorax ovate, very convex, usually projecting above in front more or less over the head; without transverse suture; scutellum small, hemispherical; abdomen usually narrow and long, composed of eight segments; hypopygium projecting forceps-like; ovipositor very short; at little developed; legs usually slender and long, especially the front pair; coxæ of moderate length. Tarsi often much elongated. Wings narrow and long; bare or uniformly hairy; anterior veins stronger and darker colored than the others; costa extending beyond the middle of the wing; auxiliary vein complete, but usually weak and slender; second longitudinal vein usually wanting; third vein sometimes united close to its origin, the upper branch often curved so as to have the appearance of a supernumerary cross-vein; fifth vein sometimes, the fifth usually, furcate; posterior cross-veins often wanting; the costal vein terminates near the tip of the wing at the termination of the third vein.

This family comprises a large number of very delicate, often beautiful, which have not been much studied by entomologists; about one thousand species are known throughout the world. They will be distinguished from the mosquitoes, which they resemble very much, by the costal vein not being continued around the posterior side of the wing. The antennæ are very plumose, especially in the males, although agreeing in this respect with male mosquitoes. The larvæ are soft-skinned worm-like, often blood-red in color and usually aquatic, as are also the pupæ, though some live in decomposing vegetable matter, or in the earth. These midges are often seen in swarms in the early spring or in the autumn, in immense numbers ascending in the air, and have doubtless in many cases given rise to exaggerated stories of mosquitoes. Over wood-

ows in the Rocky Mountains the writer has seen them rise at nightfall in the most incredible numbers, producing a humming noise like that of a distant waterfall, and audible for a considerable distance. While at rest they usually raise their forelegs in the air and keep them constantly vibrating. Aquatic larvæ may be frequently met with in standing water, often extremely delicate little creatures, so transparent as to be hardly distinguishable; they have been dredged from nearly one thousand feet below the surface of Lake Superior.

Most of the species are inoffensive, or actually beneficial as scavengers. There are some, however, belonging to the genus *Ceratopogon*, and its allies, and known generally as midges, or punkies, which have the power of sucking blood and are extremely annoying. In the White Mountains, at the seashore, along mountain streams generally, and in the West Indies they are especially troublesome. The larvæ live in the flowing sap of trees, in decaying vegetation or under fallen leaves.

The following table, largely adopted from V. d. Wulp, contains many genera heretofore known only as exotic, not a few of which will doubtless be found in the United States when the family has received more attention with us.

TABLE OF GENERA.

1. Antennæ of the ♂ long-plumose or penicillate. 2
   Antennæ of the ♂ with short hairs. 13

2. Second posterior cell wanting and hence no second basal cell. . 3
   Second posterior cell present, the second basal cell complete. . 12

3. Fourth longitudinal vein furcate. 4
   Fourth longitudinal vein not furcate; antennæ with an unequal number of joints in the two sexes; antennal joints of the ♂ plumose to the tip; thorax projecting in front over the head. . . . 5

4. "Palpi composed of three joints". . . TERSESTHES Townsend.
   Palpi composed of four joints; antennæ of the male penicillate, the last joint bare; dorsum of the thorax not produced over the head. . . . . CERATOPOGON Meigen.

5. Anal angle of the wings obsolete. . . Corynoneura Winnertz.
Anal angle prominent. 6

6. Wings bare. 7
Wings hairy. 10

7. Front metatarsi as long or longer than the tibiæ. Chironomus Meigen.
Front metatarsi distinctly shorter than their tibiæ. . . . 8

8. Legs black and white annulate. . . Cricotopus V. d. Wulp.
Legs unicolorous or with portions darker. 9

9. Posterior branch of the posterior furcation sinuous.
Camptocladius V. d. Wulp.
Posterior branch of the posterior furcation straight.
Orthocladius V. d. Wulp.

10. Front metatarsi longer than their tibiæ. Tanytarsus V. d. Wulp.
Front metatarsi shorter than their tibiæ. 11

11. Thorax produced conically in front over the head; hind tibiæ dilated and hairy. . . . . Eurycnemus V. d. Wulp.
Thorax moderately produced; hind tibiæ not dilated.
Metriocnemus V. d. Wulp.

12. Antennæ with an unequal number of joints in the two sexes (♂14, ♀7); penultimate joint of the front tarsi usually short and broad.
Diamesa Meigen.
Antennæ with an equal number of joints in the two sexes (15); the penultimate joint of the front tarsi longer than the ultimate joint.
Tanypus Meigen.

13. Proboscis and palpi rudimentary; abdomen shorter than the thorax.
Clunio Haliday.
Proboscis and palpi as usual; abdomen at least as long as the thorax. 14

14. Palpi three-jointed. . . . . Tersesthes Townsend.
Palpi four-jointed. 15

15. Antennæ with the same number of joints in both sexes. . . 16
Antennæ with an unequal number of joints in ♂ and ♀; legs moderately long, the front tarsi the longest; thorax produced over the head; wings shorter than the abdomen. . Hydrobænus Fries.

16. Antennæ with seven joints in ♂ and ♀. Chasmatonotus Loew.
Antennæ with fifteen joints in ♂ and ♀. 17

17. Wings hyaline. . . . . Macropeza Meigen.
Wings spotted (West Indies). . . . . Œcacta Poey.

6. ORPHNEPHILIDÆ.

Small, obscurely reddish yellow, bare flies of peculiar appearance. Head small, round; eyes round, contiguous in front; ocelli wanting; proboscis short; palpi longer than the antennæ, five-jointed, the first joint short, the second the thickest; antennæ situated near the oral margin, apparently consisting of a small first joint, an oval second joint and a terminal arista; the second joint and the arista are, however, complex, the first composed of three and the latter of seven segments, the last of which terminates in a bristle. Thorax strongly convex, robust, without transverse suture, somewhat impressed before the scutellum. Scutellum rather large, obtusely three cornered; metanotum arched. Abdomen narrower than the thorax, cylindrical, composed of seven segments; male genitalia thick, the basal piece swollen, bladder-like; ovipositor with broad, rounded lamellæ. Legs simple, comparatively short; coxæ not elongated; tibiæ without spurs; tarsi moderately long; the front pair longer than the tibiæ, the penultimate joint short; claws small; pulvilli distinct. Wings longer than the abdomen; auxiliary vein short, terminating in the costa; second longitudinal vein sinuous; third and fourth veins not furcate; anal angle rounded; basal cells short.

But two or three species of this singular family are known, and of them even, so far as I can learn, the larval habits are yet unknown. The species all belong to one genus, *Orphnephila* Haliday. The small fly is found on the banks of streams.

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7. PSYCHODIDÆ.

Very thickly haired, minute flies, in appearance lepidoptera-like. Head small; ocelli wanting. Antennæ as long as the head and thorax together, bead-like; thickly haired, composed of from twelve to sixteen joints; the two basal joints thicker and short-cylindric. Proboscis usually short; in some exotic genera (*Phlebotomus*) elongated and horny; palpi incurved

and hairy; composed of four joints of nearly equal length. Thorax not very convex, without transverse suture; scutellum rounded. Abdomen cylindrical, composed of from six to eight joints; male genitalia prominent. Legs very short, densely hairy; claws small; pulvilli rudimentary. Wings large, ovate in shape; when at rest lying roof-shaped over the abdomen; densely covered with long hairs or tomentum, which also forms a fringe around their margin; the costal vein continuous around the wing; veins strong, for the most part concealed beneath the hair; neuration formed almost wholly by longitudinal veins; the anterior cross-vein is very short, and lies very near the root of the wing; auxiliary vein weak or indistinct; first longitudinal vein very near the costa; second longitudinal vein arises very near the origin of the first, and is usually twice forked, that is, the upper branch of the furcation is again furcate; third vein simple, terminating at or beyond the tip of the wing; fourth vein furcate; fifth and sixth terminating in the border of the wing; seventh vein usually distinct, reaching to the margin of the wing, sometimes wanting.

The members of this family are often very minute, rarely exceeding the length of four millimeters; they occur in shady places, on windows, about outhouses, and will be readily recognized from their peculiar moth-like appearance; they run about nimbly, but their flight is weak. The larvæ live in rotting vegetable material, or in water, especially stagnant water; they are cylindrical, with the posterior end terminating in a short, usually firmly chitinized, stigmatic tube; the maxillæ are imperfectly developed, there are eye-spots on the head, and the segment behind the head are without feet. The pupæ are inactive, with two long tube-like, anterior stigmata.

But two genera are known to occur in North America; *Psychoda* and *Pericoma*, which may be distinguished from each other by the termination of the third vein of the wing,

which is at or before the tip in *Psychoda*, and distinctly behind it in *Pericoma*. In their study, one should use preferably a compound microscope, and it may be necessary either to mount a wing, or at least to remove the scales. Attention should be paid to the shape of the antennæ and palpi, as well as the genitalia, legs and wings. *Psychoda alternata* Say is our most common species, apparently extending over all the United States.

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8. DIXIDÆ.

Rather small, slender, nearly bare species. Proboscis somewhat projecting; palpi four-jointed; antennæ long, the basal joints thick, those of the flagellum hair-like, and the joints indistinctly distinguishable. Eyes round, dichoptic; no ocelli. Thorax strongly convex, without transverse suture; scutellum transverse; metanotum arched. Abdomen long and slender, composed of seven or eight segments, thickened posteriorly in the male, pointed in the female. Legs long and slender; coxæ somewhat elongated; tibiæ without terminal spurs. Wings comparatively large; auxiliary vein present, terminating in the costa before the middle of the wing; the second vein arises from the first near the middle of the wing and appears to be the beginning of the third vein, which continues its direction while the second arches suddenly forward at the anterior cross-vein and is furcate; fourth vein furcate; four posterior cells present; the two basal cells very large; the anterior cross-vein is placed at the beginning of the third vein, where the second vein curves forward.

The family Dixidæ comprises about a score of known species belonging to the single genus *Dixa*. It has been placed among the Tipulidæ and Culicidæ, but seems best isolated into a separate family. The larvæ are aquatic, resembling those of the mosquitoes. The flies are found in bushy, moist places about forests, and have been observed by Winnertz dancing in the air in swarms.

9. TIPULIDÆ.

Large to moderately small, slender flies, with long, slender legs. Head spherical, occiput strongly developed; face often produced snout-like. Eyes round, separated by the broad front; sometimes approximated below the antennæ; ocelli usually wanting. Antennæ rarely shorter, usually longer than the head and thorax together; bead or thread-like, composed of from six to nineteen joints; the joints of flagellum never plumose, but usually with more or less conspicuous, bristly hairs; the joints sometimes serrated. Proboscis more or less projecting, in a few genera very much elongated; palpi four or five jointed; the terminal joint often elongated, whiplash-like. Thorax convex, usually with a very distinct suture in the form of a shallow V; pro-thorax usually distinct, collar-like; scutellum half round; metanotum strongly developed. Abdomen cylindrical, composed of seven or eight segments; genitalia prominent, in the male very variable in structure; in the female the ovipositor with two pairs of long, horny, pointed valves. Legs very long and slender; the tibiæ sometimes with terminal spurs. Wings long, but comparatively narrow; in rest spread apart or lying parallel over the abdomen; always six longitudinal veins; usually a complete discal cell; both basal cells long; the anal cell usually open; seventh vein distinct (save in the *Ptychopterinæ*) and of variable form; alulets rounded, rarely angular.

The family Tipulidæ comprises the largest of the Nematocerous flies, some of which exceed two inches in length. The legs are very elongate and delicate, so delicate, indeed, that one seldom succeeds in capturing the flies without the loss of one or more. Flies of this description with a distinctly impressed V-shaped suture on the dorsum of the thorax will be immediately recognized as belonging to this family. The female differs from most other flies in having the ovipositor often adapted for depositing eggs within the ground or other firm substances. When the weather is favorable the eggs hatch

out in a little more than a week. The larvæ are ash-gray or brownish in color, more or less transparent, composed of twelve segments. The head is incompletely differentiated and retractile, and has the maxillæ and mandibles more or less horny and stout; there are short fleshy antennæ. The organs of locomotion generally consist of transverse swellings on the under side of the body, provided with very minute, stiff bristles. The anal end of the body is truncate, with a single pair of spiracles; and the margins of the truncature are for the most part provided with fleshy retractile processes of variable size and shape. In the aquatic larvæ there is a long tube at the end of the body which serves for breathing when raised to the surface of the water.

Most of the larvæ live in the earth or in soil-like, decomposing wood, in fungi, or in water. Others live on the leaves of plants and are like caterpillars in appearance, the resemblance to which is yet more heightened by the green color, with a crest of tubercles on the back.

The pupæ, like those of many of the members of this suborder are free. The thorax has two horn-like processes which represent the thoracic spiracles, one of which may acquire a very great length, for the purpose of breathing from the surface while under water. The abdominal segments have transverse rows of hairs, bristles or spines, which enable the pupa to escape from its place of concealment when about to complete its metamorphosis.

The adult flies are commonly seen in the late summer and autumn. They will be most usually met with in meadow-lands and forests, flying awkwardly for a few steps, close to the ground till they become entangled in the grass or twigs, and then, extricating themselves, rising again to repeat the same aimless, clumsy flight.

The name of "daddy-long-legs" is the one most usually applied to members of this family in England, but in America this term is commonly used to designate the Phalangidæ or

harvest spiders. The English name of "crane-flies" is preferable. Commonly they are harmless, but some of the species in the larval state are very destructive, feeding upon the tender rootlets of grass and grain, and causing the plants over large surfaces to wither and die. There are about twelve hundred species known.

In this family are placed several wingless forms, or those with the wings more or less rudimentary. One of the former is *Chionea*, the species of which are found on snow, often in the coldest weather.

The family Tipulidæ is easily divided into three subfamilies, which I prefer to call the Ptychopterinæ, Limnobiinæ and Tipulinæ, and which correspond precisely with the Ptychopterina, Tipulidæ longipalpi and Tipulidæ brevipalpi of Osten Sacken.

TABLE OF GENERA.

1. Seventh longitudinal vein present, that is there are two longitudinal veins between the fifth vein and the posterior margin of the wing. 2
   Seventh longitudinal vein absent; no distinct V-shaped suture on mesonotum. . . . . PTYCHOPTERINÆ.

2. Last joint of the palpi shorter or not much longer than the two preceding together; the auxiliary vein usually ends in the costa and is connected with the first longitudinal vein by a distinct cross-vein; antennæ six to sixteen jointed. . . . . LIMNOBIINÆ.
   Last joint of the palpi whiplash-like, much longer than the three preceding together; antennæ composed of not more than thirteen joints; the auxiliary vein ends in the first longitudinal vein by an abrupt curvature at the tip, not connected with the first vein by a cross-vein. . . . . TIPULINÆ.

LIMNOBIINÆ.

1. Wingless, spider-like in appearance. . . . CHIONEA Dalman.
   Winged. 2

2. Antennæ composed of apparently 28 joints, long; anal cell closed; no empodia or spurs (West Indies, South America).
   POLYMERA Wiedemann.
   Antennæ not apparently composed of more than 16 joints. . . 3

3. Posterior cross-vein situated before the middle of the wing; three posterior cells present (West Indies). . . Thambetá Williston.
Posterior cross-vein not situated before the middle of the wing. . 4

4. A single submarginal cell present. 5
Two submarginal cells present. 7

5. Antennæ 14-jointed. . . . . Limnobiini.
Antennæ 16-jointed. 6

6. Tibiæ with spurs at the tip; the first longitudinal vein usually ends in the second. . . . . Cylindrotomini.
Tibiæ without spurs; the first vein ends in the costa. . Antochini.

7. Tibiæ without spurs at the tip. . . . . Eriopterini.
Tibiæ with spurs at the tip. 8

8. The subcostal cross-vein is beyond the origin of the second longitudinal vein. 9
The subcostal cross-vein is before the origin of the second longitudinal vein. . . . . Amalopini.

9. Antennæ composed of sixteen joints. . . . Limnophilini.
Antennæ composed of from six to ten joints, often much elongated. Anisomerini.

LIMNOBIINI.

1. Proboscis longer than the head and thorax together. Geranomyia Haliday.
Proboscis shorter than the head and thorax together. . . . 2

2. Antennæ pectinate or subpectinate, at least. in the male. Rhipidia Meigen.
Antennæ not pectinate. 3

3. A supernumerary cross-vein between the sixth and seventh veins. Trochobola Osten Sacken.
No cross-vein connecting the sixth and seventh veins. . . . 4

4. Tip of the auxiliary vein usually opposite, or before, or only a short distance beyond the origin of the second vein; marginal cross-vein always at the tip of the first longitudinal vein; legs slender. Dicranomyia Stephens.
Tip of the auxiliary vein usually far beyond the origin of the second vein; marginal cross-vein sometimes at the tip but often some distance before the tip of the first vein; legs comparatively stout. Limnobia Meigen.

ANTOCHINI.

1. Rostrum at least as long as the head, sometimes very long; no marginal cross-vein. 2
   Rostrum shorter than the head. 4

2. Wings without submarginal cell. . . . . Toxorrhina Loew.
   Wings with a submarginal cell. 3

3. Rostrum not much longer than the head. . Rhamphidia Meigen.
   Rostrum the length of the whole body. Elephantomyia Osten Sacken.

4. Discal cell open. 5
   Discal cell closed. 6

5. Second basal cell considerably shorter than the first, the great cross-vein more proximal than the origin of the second vein; three posterior cells. . . . . Diotrepha Osten Sacken.
   Second basal cell of about the same length as the first.
   Elliptera Schiner.

6. No marginal cross-vein whatever. . . . Atarba Osten Sacken.
   Marginal cross-vein present. 7

7. First longitudinal vein ends in the costa nearly opposite the inner end of the submarginal cell. 8
   The first vein ends in the costa far beyond the inner end of the submarginal cell. . . . . Dicranoptycha Osten Sacken.

8. Submarginal cell as long or but little longer than the first posterior cell.
   Teucholabis Osten Sacken.
   Submarginal cell much longer than the first posterior cell.
   Antocha Osten Sacken.

ERIOPTERINI.

1. Five posterior cells. . . . . Cladura Osten Sacken.
   Four posterior cells. 2

2. The inner marginal cell has almost the shape of an equilateral triangle.
   Cryptolabis Osten Sacken.
   Inner marginal cell of the usual shape. 3

3. Wings conspicuously hairy on the whole surface or along the veins. 4
   Wings not conspicuously hairy, veins bare or nearly so.* . . 6

4. Wings hairy on the whole surface. . Rhypholophus Kolenati.
   Wings hairy along the veins only. 5

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* Antennal joints subreniform and nodose; the eyes nearly contiguous above and below (Central America). . Sigmatomera Osten Sacken.

5. Second submarginal cell longer than the first; ERIOPTERA Meigen.
   First submarginal cell longer than the second. MOLOPHILUS Curtis.

6. First submarginal cell short, not more than half the length of the second. 7
   First submarginal cell more than half the length of the second. 10

7. Marginal cross-vein present. 8
   Marginal cross-vein absent. . . . GONOMYIA Osten Sacken.

8. Second submarginal cell in contact with the discal cell, the anterior cross-vein obsolete. 9
   Anterior cross-vein present, the first posterior cell intervening between the submarginal and the discal cells. . EMPEDA Osten Sacken.

9. Anal cell closed; no empodia (Asia, Africa and West Indies).
   MONGOMA Westwood.
   Anal cell open; empodia present (Central and South America).
   PARATROPESA Schiner.

10. Seventh longitudinal vein conspicuously bisinuate. SYMPLECTA Meigen.
    Seventh longitudinal vein straight. 11

11. Length of the auxiliary vein beyond the cross-vein at least twice that of the posterior cross-vein. . . TRIMICRA Osten Sacken.
    The cross-vein situated near the end of the auxiliary vein.
    GNOPHOMYIA Osten Sacken.

LIMNOPHILINI.

1. Discal cell open; antennæ apparently 28-jointed in the ♂.
   POLYMERA Wiedemann.
   Discal cell closed. 2

2. Marginal cross-vein wanting. . . PHYLLOLABIS Osten Sacken.
   Marginal cross-vein present. 3

3. Wings pubescent. . . . . ULOMORPHA Osten Sacken.
   Wings bare. 4

4. Seventh vein very short, abruptly incurved toward the anal angle.
   TRICHOCERA Meigen.
   Seventh vein not unusual. 5

5. A supernumerary cross-vein between the auxiliary vein and the costa.
   EPIPHRAGMA Osten Sacken.
   No such supernumerary cross-vein. . . LIMNOPHILA Macquart.

ANISOMERINI.

1. Three posterior cells; two submarginal cells. ANISOMERA Meigen.
   Four or five posterior cells; antennæ of the ♂ sometimes much elongated. 2

2. The stigma occupies nearly the whole space between the tip of the auxiliary vein and the marginal cross-vein. . . ERIOCERA Macquart.
   The stigma occupies but a small portion of the space between the tip of the auxiliary vein and marginal cross-vein. PENTHOPTERA Schiner.

AMALOPINI.

1. Antennæ composed of thirteen joints. 2
   Antennæ composed of sixteen or seventeen joints. . . . 4

2. Two cross-veins between the first longitudinal vein and the anterior branch of the second vein. . . . DICRANOTA Zetterstedt.
   Only one cross-vein between these veins. 5

3. Five posterior cells, both branches of the fourth vein furcate.
   RHAPHIDOLABIS Osten Sacken.
   Four posterior cells, the posterior branch furcate.
   PLECTROMYIA Osten Sacken.

4. Four posterior cells; wings pubescent. . . . ULA Haliday.
   Five posterior cells; wings bare. 5

5. Anterior cross-vein nearly at right angles with the longitudinal axis of the wing. . . . . AMALOPIS Haliday.
   Anterior cross-vein at a very oblique angle with the longitudinal axis of the wing and parallel with the posterior cross-vein.
   PEDICIA Latreille.

CYLINDROTOMINI.

1. Five posterior cells; colors yellow and black.
   CYLINDROTOMA Macquart.
   Four posterior cells. 2

2. Antennal joints subcylindrical, elongated. 3
   Antennal joints subglobular; head and thorax conspicuously punctulate.
   TRIOGMA Schiner.

3. Colors yellow and black. . . . . LIOGMA Osten Sacken.
   Colors brownish and grayish. . . . PHALACROCERA Schiner.

PTYCHOPTERINÆ.

1. First submarginal cell much shorter than the second.
   IDIOPLASTA Osten Sacken.
   First submarginal cell much longer than the second. . . . 2

2. Three posterior cells. . . . . Bittacomorpha Westwood.
Four posterior cells. . . . . Ptychoptera Meigen.

TIPULINÆ.

1. Legs long and slender, especially the tarsi; anterior branch of the second vein absent, obsolete or perpendicular, the rhomboid cell more or less square. 2

Legs not unusually slender, anterior branch of second vein present and oblique. 5

2. Antennæ thirteen-jointed; male forceps complex.
Dolichopeza Curtis.
Antennæ with less than thirteen joints; male forceps small, simple. 3

3. Fifth posterior cell not in contact with discal cell.
Megistocera Wedemann.
Fifth posterior cell in contact with discal cell. 4

4. Head on a neck-like prolongation of the thorax; seventh vein short, running into the anal angle. . Brachypremna Osten Sacken.
Head more closely applied to the thorax; seventh vein terminates in the margin at some distance from the anal angle.
Tanypremna Osten Sacken.

5. Antennæ of ♂ pectinate or sub-pectinate. 6
Antennæ not pectinate. 7

6. Ovipositor of ♀ long, sword-like. . . . Xiphura Brulle.
Ovipositor of ♀ long but not sword-like. . Ctenophora Meigen.

7. Three posterior veins arising from the discal cell, the two anterior sometimes arising together but the petiole always short.
Pachyrrhina Macquart.
Two posterior veins arise from the discal cell the anterior one furcate, petiole always of considerable length. 8

8. Antennæ serrate; northern species. . . Stygeropis Loew.
Antennæ not serrate below. 9

9. Marginal vein wanting, but one marginal cell, antennal joints short with minute bristles. . . . . Holorusia Loew.
Two marginal cells. 10

10. Abdomen slender, very long; antennæ composed of twelve joints.
Longuria Loew.
Abdomen less elongate; antennæ with thirteen joints. Tipula Linne.

10. BIBIONIDÆ.

Moderately slender flies, of from three to ten millimeters in length. Head usually somewhat flattened; front in the male very narrow, or the eyes contiguous; face short; eyes round or reniform, often densely hairy in the male; ocelli large, distinct. Antennæ with from nine to twelve joints, cylindrical, not longer than the head and thorax together, the joints closely united. Proboscis not long, with thickened, hairy labella; palpi variable, sometimes long, with four or five distinct joints, at other times short. Thorax without suture; scutellum half round. Abdomen composed of seven or eight segments, not short. Legs moderately long and strong, the hind pair more or less elongated, the front femora thickened; front tibiæ usually with a stout hook or coronet of spines at the tip; pulvilli and empodium distinct, the latter often pulvilliform. Wings large, the anterior veins stouter than the posterior ones; costa not extending on the posterior margin; second longitudinal vein wanting, the third arising from the first; third vein sometimes furcate; fourth usually furcate; first basal and sometimes the second basal cell present; no discal cell.

This family comprises about three hundred described species and is of wide distribution. The larvæ are cylindrical, footless, with transverse rows of bristles, usually with eyes; they feed on excremental or vegetable substances, especially on the roots of grass. The pupæ are inactive, mostly free, living in excavated, smooth, oval cavities near the surface of the ground, which the larvæ have prepared before undergoing their metamorphosis, and where the pupæ remain before emerging in the perfect form. In some species the males differ very markedly in coloration from the females, so much so that they are commonly mistaken for different species; they are easily distinguished for their very large eyes which comprise nearly the whole head and are covered with hairs. One of the most common species is *Bibio albipennis* which

occurs early in the spring, in great numbers, especially about willows, and in gardens. It is conspicuous for its white wings and black color, and like most other members of the family is slow in its movements, flying heavily. *B. femorata*, a common species, is of a deep red color with black wings. *B. tristis* has been observed in large numbers in many Kansas wheat-fields, during the last week of April, apparently without causing damage.

1. Second basal cell present. 2
   Second basal cell wanting. 5

2. Third longitudinal vein furcate. 3
   Third vein not furcate. 4

3. Palpi four-jointed; first antennal joint elongate. HESPERINUS Walker.
   Palpi five-jointed. . . . . PLECIA Wiedemann.

4. Front tibiæ with a stout, spine-like process at the tip. BIBIO Geoffrey.
   Front tibiæ with a terminal coronet of spines. DILOPHUS Meigen.

5. Front tibiæ ending in a spine-like process. . . ASPISTES Meigen.
   Front tibiæ of the usual structure; third vein not furcate; hind metatarsi shorter than the remaining joints together. SCATOPSE Geoffrey.

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11. SIMULIIDÆ.

Small flies, from three to six mm. in length, with thick, compressed, short legs. Head hemispherical; face short; eyes round or reniform, holoptic in the male; no ocelli. Antennæ scarcely longer than the head, cylindrical, ten-jointed; the two basal joints differentiated, the others closely united. Proboscis not elongated, with small, horny labella; palpi incurvate, four-jointed; the first joint short and the two following of equal length; the last one longer and more slender than the preceding. Thorax ovate, without suture; the scutellum small. Abdomen cylindrical, composed of seven or eight segments; genitalia concealed; legs strong and not elongated; femora broad and flat; tibiæ without terminal spurs; first joint of the tarsi longer than the following and usually

dilated in the male; the last joint very small. Wings large and broad, with distinct alulæ, anterior veins thickened, the others slender; auxiliary vein terminating in the costa about the middle of the wing; humeral cross-vein present; second longitudinal vein wanting, the first and third lying close by each other; the third arising from the first rectangularly before the end of the auxiliary vein; anterior cross-vein very short; fourth vein curved, forked nearly opposite the anterior cross-vein; the forks terminating near the tip of the wing.

The family Simuliidæ, comprising about seventy-five known species, is one of the best known popularly among diptera, on account of the troublesome character of the flies, which are scarcely less annoying than the true mosquito; they rarely exceed five or six mm. in length, usually not more than three or four, and will be immediately distinguished from the mosquito by their thick-set appearance, their shorter legs, their shorter proboscis, and less slender antennæ. In the southern States they are known as "buffalo gnats" and "turkey gnats", and sometimes occur in almost incredible numbers; cattle when attacked by large numbers are driven almost frantic, and will seek to evade them by rolling in the dust, rushing about, or going into the water. When the flies are numerous they will almost literally cover the cattle, especially seeking the openings of the body, entering the nostrils and the ears, the margins of the eyes, where they will actually lie piled upon each other. When very numerous they will produce an inflammatory fever, frequently terminating in death. The well known European species is *S. columbaczense*, which during some seasons in the regions of the Danube costs the death of many cattle.

The larvæ are very interesting creatures; they are aquatic, living most frequently in mountain streams, on stems of plants, or stones, where they form for themselves elongated cocoons, opened above. In the open end of these cocoons the pupæ ensconce themselves with the anterior part of the body

naked and free, from which extend eight or sixteen very long, slender, threadlike breathing tubes. The perfect insect escapes under water and comes to the surface. The larvæ are soft-skinned, thickened at the extremities, with a cylindrical head, two pairs of eyespots; on the first thoracic segment there is a foot protuberance with bristly hooklets; and the end of the abdomen has several appendages for attachment.

But one genus is known in the family, *Simulium*, which will be recognized from the characters already given.

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12. RHYPHIDÆ.

Head nearly hemispherical; eyes rounded, holoptic, or nearly so in the male; broadly separated by the front in the female; ocelli present. Antennæ about as long as the thorax, composed of sixteen joints, cylindrical, the two basal joints distinctly differentiated; those of the flagellum closely united, short-haired, gradually decreasing in size toward the end. Proboscis moderately prominent, with small labella; palpi very long, four-jointed; the second joint longer and broader than the others. Thorax convex, without transverse suture; scutellum semicircular, short and broad; metanotum strongly developed. Abdomen cylindrical, composed of seven segments; genitalia concealed or nearly so. Legs slender, without spines; the coxæ, especially the front pair, more or less elongated; metatarsi elongated; tibiæ without spurs or the hind pair with minute ones; empodia pad-like, the pulvilli absent. Wings large, in rest lying flat upon the abdomen; auxiliary vein present; the costal vein reaching to the tip of the third vein. Discal cell present, from which three veins originate, and a fourth arises from the posterior basal cell; five posterior cells and two elongated basal cells present; a distinct stigma.

But very few species of this family are known, belonging to but two or three genera. The typical genus *Rhyphus* con-

tains a number of species of wide distribution, specimens of which are frequently found about the windows of dwelling houses. The genus *Olbiogaster* has recently been described from Mexico, "It differs from *Rhyphus* in the structure of the head (eyes separated by a broad front in both sexes, and occiput but very little developed), of the antennæ (scapus short, flagellum of male filiform, etc.), of the thorax and abdomen, as also in the venation." (Osten Sacken.)

The larvæ of *Rhyphus* are worm-like, legless, naked, more or less transparent, with snake-like movements; there are two short fleshy points at the posterior end. The pupæ are free, inactive, with two projections anteriorly; they live in water, brooks, pools, or puddles, or in rotting wood, hollow trees, or manure.

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13. LEPTIDÆ.

Species of moderate or large size, more or less elongated, usually thinly pilose or nearly bare, without distinct bristles. Males holoptic or dichoptic. Empodia developed pulvilliform, the pulvilli present. Tegulæ small or rudimentary. Third joint of the antennæ complex or simple, with or without a terminal or dorsal arista or terminal style. Veins of the wings distinct, not crowded anteriorily; third longitudinal vein furcate; basal cells large; five posterior cells usually present.

As defined above, this family includes the Xylophagidæ, Leptidæ and Coenomyidæ of authors. It may be a question whether this union is justifiable, but, on the whole, it seems that the sole character which can be used to distinguish the families—the structure of the third antennal joint—divides the group unnaturally, throwing with the Xylophagidæ forms whose affinities are greatest with the Leptidæ, notwithstanding the antennal character.

The Xylophaginæ include less than one hundred known forms, and many of them are remarkable for their general

resemblance to certain hymenopterous insects. Species of *Rhachicerus* form a connecting link with the Nematocera, and are apt to be confounded with the Rhyphidæ, but the presence of the pulvilli will distinguish them. The larvæ are found in decaying wood or under the bark of trees and are carnivorous and predaceous, feeding upon the larvæ of beetles and other wood insects. The skin is parchment-like, the body cylindrical. The mouth-parts and antennæ are very small, the maxillæ short and hook-like. The first or the first three segments back of the head are chitinized above; the last segment above with a chitinized plate terminating posteriorly in two hooks. The fourth to the ninth segments have bristly pseudopods below. The pupæ are free.

The Leptinæ comprise something over two hundred known species. They are usually of moderate size and not very active in their habits. The larger species are commonly found in meadows and woodlands, resting upon stems or trunks of trees with their head downward. They are sometimes predaceous upon other insects and the species of *Symphoromyia* have a habit of sucking blood as do the horseflies. The larvæ are predaceous, living in the earth, in decaying wood or in passages made by woodboring beetles. Others live in moss, in sand or in water. The eggs of *Atherix* are deposited in dense masses attached to dry branches overhanging water. Not only do numerous females contribute to the formation of these masses, but they remain there themselves and die. The larvæ hatching, escape into the water. The flies of species of *Vermileo* deposit their eggs in sand, and the larvæ form conical pitfalls in which to ensnare small insects. The tenth segment of these larvæ bears above at its tip a transverse row of long hooklets directed backward, but with the hooks bent forward; the eleventh segment has a similar row directed forward, the hooks of which are turned backward. On the fifth segment below there is a simple unpaired grasping foot which is capable of being protruded forward and downward;

at its tip there are two triangular, sharp, flat, chitinous hooks, and below them some stiff bristles. The hooklets serve as aids in boring in the sand and to fix themselves; the organ on the fifth segment enables the larva to seize and hold its prey, and also in constructing the pitfalls. The larvæ of the Leptinæ in general are cylindrical, with or without fleshy abdominal legs. The last segment has a transverse cleft, the portion above which is provided with two, often backward-bent points or processes; the under part is obtuse, with the two stigmata between them.

TABLE OF GENERA.

1. Third joint of the antennæ complex, the antennæ more or less elongated; five posterior cells present. 2
   Antennæ short or but little elongated, the third joint simple, with a terminal or dorsal arista or a terminal style; face small, excavated; proboscis short; some or all of the tibiæ spurred. . LEPTINÆ.

2. All the tibiæ with spurs. . . . . XYLOPHAGINÆ.
   Front tibiæ without spurs. . . . . ARTHROCERATINÆ.

XYLOPHAGINÆ.

1. All four posterior veins (i. e. the veins separating the posterior cells) arise from the discal cell; head small; scutellum with spines. COENOMYIA Latreille.
   The last posterior vein arises from the second basal cell, the fifth posterior cell hence not contiguous at its base with the discal cell; scutellum without spines. 2

2. Third joint of the antennæ acute at tip, . . ARTHROPEAS Loew.
   Third joint of antennæ not acute at tip. 3

3. Fourth posterior cell closed; the third joint of the antennæ much elongate, composed of numerous, distinct divisions, often pectinate; eyes emarginate near the antennæ. . . . RHACHICERUS Haliday
   Fourth posterior cell open; third joint of antennæ composed of eight annuli, indistinctly separated. . . . XYLOPHAGUS Meigen.

ARTHROCERATINÆ.

1. Fourth posterior cell open. 2
   Fourth posterior cell closed. (*Subula* preoc.) SUBULA OMYIA nom. nov.

2. Face projecting on each side in a rounded, conical protuberance, thickly covered with hair. . . . . Glutops Burgess.
Face with two deep diverging furrows, running from the base of the antennæ to the oral margin. . . . Arthroceras Williston.

LEPTINÆ.

1. Front tibiæ with terminal spurs. 2
Front tibiæ without terminal spurs. 3

2. Front tibiæ with a single spur; sometimes only four posterior cells present in the wing. . . . . Dialysis Walker.
Front tibiæ with two spurs; five posterior cells as usual.
Triptotricha Loew.

3. Third joint of the antennæ round, oval or pear-shaped, its bristle distinctly terminal. 4
Third joint of the antennæ kidney-shaped, the arista more dorsal. 6

4. Anal cell open; hind tibiæ with two spurs. . Leptis Fabricius.
Anal cell closed. 5

5. Third joint of the antennæ with a slender arcuate bristle; hind tibiæ with one spur. . . . . Chrysopila Macquart.
Third antennal joint with a shorter, slender style.
{ Spania Meigen.
{ Ptiolina Zetterstedt.

6. Hind tibiæ with two spurs; anal cell closed. . Atherix Meigen.
Hind tibiæ with a single spur; anal cell open.
Symphoromyia Frauenfeld.

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14. STRATIOMYIDÆ.

Small to moderately large, nearly bare or thinly pilose, bristleless species. Head short, hemispherical or flattened, as broad as the thorax. Ocelli present. Eyes contiguous or separated by the front in the male. Antennæ porrect, approximated at the base, three-jointed, the third joint always complex, usually with a terminal style or an arista. Proboscis never elongated; palpi two or three-jointed, sometimes rudimentary. Thorax never strongly convex; scutellum often with tubercles, spines or projection on its margin. Abdomen composed of from five to seven segments, usually flattened,

often elongated. Legs never thickly pilose; without bristles, the tibiæ without spurs (except in some Beridinæ); pulvilli and empodia pad-like. The costal vein of the wings does not reach to the tip of the wing; veins often crowded anteriorly, and those posteriorly weak; discal cell present; four or five posterior cells, and one or two submarginal cells present, the anterior branch of the third vein short and often indistinct.

The family Stratiomyidæ is one of considerable size, including nearly one thousand known species. The flies are invariably flower insects, seldom with any marked powers of flight and never having the habit of hovering in the air. Not a few species are caught in beating nets or on the windows of dwelling houses. Many of the species have in life bright yellow or green markings. Their eggs are laid on the ground, on plants about water, or perhaps on the surface of the water itself. The larvæ are carnivorous, or feed upon decaying vegetable material. The larvæ of *Chrysomyia* have been found in cow-dung, and under stones; those of *Sargus* in the flowing sap of elm trees; those of *Hermetia* in privies; those of *Pachygaster* in decaying wood; those of *Beris* in moss; those of *Stratiomyia*, *Odontomyia*, *Nemotelus*, etc., in water. The larvæ of *Stratiomyia* have been found in salt and alkaline water. The body is smooth and flattened, the last segment often prolonged into an elongated breathing tube and with a terminal transverse cleft. The pupæ are inactive, remaining within the larval skin, the pupal skin remaining within, or partially within, the larval skin when the fly escapes through a longitudinal rent.

TABLE OF GENERA.

1. Abdomen with seven visible segments. . . . . BERIDINÆ.
   Abdomen with five or six visible segments. 2

2. Three posterior veins,* all arising from the discal cell. PACHYGASTRINÆ.
   Four posterior veins, the anterior ones sometimes rudimentary. . 3

* By posterior veins is meant those separating the posterior cells.

3. All the posterior veins arise from the discal cell, the fifth posterior cell hence contiguous with the discal cell. 4
   The last posterior vein arises from the second basal cell. . . 5

4. Third joint of the antennæ with a long, delicately fringed, lamelliform style; usually large, more or less elongated species; males dichoptic (Hermetiinæ). . . . . Hermetia Latreille.
   Third antennal joint not with such a style; abdomen short.
   Clitellarinæ.

5. Antennæ with a slender dorsal or terminal, bare or pubescent arista.
   Sarginæ.
   Antennæ never with a slender or long arista. . . Stratiomyinæ.

BERIDINÆ.

1. Three posterior veins, all arising from the discal cell.* . . 2
   Four posterior veins, all arising from the discal cell; scutellum with spines. 6

2. Scutellum without spines. 3
   Scutellum with spines. 4

3. Short, small species. . . . . Allognosta Osten Sacken.
   Elongate, larger species; head sometimes small. (Central and South America). . . . . Chiromyza Weidemann.

4. Scutellum with ten spines (Central and South America).
   Heteracantha Schiner.
   Scutellum with not more than six spines. 5

5. Head hemispherical. . . . . Beris Latreille.
   Head not hemispherical, the front much flattened and elongate (Central America). . . . . Berismyia Giglio-Tos.

6. Occiput flattened; hind femora simple; the last two abdominal segments small. . . . . Scoliopelta Williston.
   Occiput excavated; hind femora thickened at the extremity.
   Neoexaireta Osten Sacken.

SARGINÆ.

1. Antennæ elongate, with a terminal, pubescent style (Central and South America). . . . . Acrochæta Wiedemann.
   Antennæ short with an apical or preapical arista. 2

2. Scutellum with two spines (Central and South America).†
   Rhaphiocera Wiedemann.
   Scutellum without spines. 3

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* Variable in *Beris*.

† If but a single submarginal cell present, compare *Nothomyia* (Stratiomyinæ?).

3. Anterior ocellus more widely separated than the other two; males holoptic or dichoptic. 4
Ocelli equidistant, more approximated. 5

4. Abdomen contracted near the base, clavate or pedicillate.
MACROSARGUS Bigot.
Abdomen not pedicillate or clavate. . . . SARGUS Fabricius.

5. Second antennal joint prolonged on the inner side, extending on and closely lying upon the third joint. . . . PTECTICUS Loew.
Second antennal joint not with such a projection. 6

6. Hind femora moderately thickened on the proximal portion; origin of the second vein near the anterior cross-vein (Central and South America). . . . . MEROSARGUS Loew.
Hind femora slender, or the second vein remote from the anterior cross-vein. 7

7. Third joint of the antennæ pointed, the arista somewhat thickened; first antennal joint moderately long (Central and South America).
HISTIODROMA Schiner.
Third antennal joint oval, the arista slender. 8

8. Elongate species (*Chrysonotus* preoc.) . CHRYSOCHROMA, nom. nov.
Deep metallic species; abdomen short; eyes of male with an area of enlarged facets above; front of female broad. MICROCHRYSA Loew.

STRATIOMYINÆ.

1. Third longitudinal vein with an anterior branch; third joint of antennæ elongate. 2
Third longitudinal vein without anterior branch. 6

2. Scutellum without spines; first two joints of the antennæ short (Central and South America). . . . CHORDONOTA Gerstæcker.
Scutellum with spines, rarely wanting in *Odontomyia*. . . . 3

3. Third joint of the antennæ composed of from three to five annuli. 4
Third joint composed of seven or eight annuli. 5

4. First antennal joint three or four times the length of the second.
STRATIOMYIA Geoffroy.
First antennal joint less than three times the length of the second.
ODONTOMYIA Meigen.

5. Third antennal joint elongate, terminating in a point; first joint two or three times the length of the second (Central and South America and West Indies). . . . . CYPHOMYIA Wiedemann.
Third antennal joint terminating in a bristle; first joint but little longer than the second (Central and South America).
NEORONDANIA Osten Sacken.

6. Face produced conically downwards; antennæ elongate.
Myxosargus Brauer.
Face not produced conically; third antennal joint oval with a terminal arista. . . . . Nothomyia Loew.

CLITELLARINÆ.

1. Scutellum without spines. 7
Scutellum with spines. 2
2. Antennæ short, with a subterminal arista. . . Oxycera Meigen.
Antennæ more or less elongate. 3
3. Antennæ situated near the oral margin; third joint composed of six annuli (Central and South America). . Euryneura Schiner.
Antennæ situated near or a little below the middle of the head in profile. 4
4. Antennæ much elongated; style not differentiated; eyes bare; smaller species. . . . . Euparhyphus Gerstæcker.
Antennæ moderately elongated. 5
5. Style of antennæ not differentiated. . . Scoliopelta Williston.
Style of antennæ distinctly differentiated. 6
6. Eyes pilose; antennæ with a slender style. Clitellaria Meigen.
Eyes bare; style not slender (Central America).
Aochletus Osten Sacken.
7. Face conically produced downward. . . Nemotelus Geoffroy.
Face not conically produced. 8
8. Third antennal joint with a long slender arista, longer than the antennæ; eyes bare (Central and South America and the West Indies).
Chrysochlora Macquart.
Eyes pilose; antennæ with a short, thickened, divaricate, hairy style, terminating in a short slender bristle; second joint of antennæ not with a finger-like projection over the third joint (West Indies).
Pelagomyia Williston.

PACHYGASTRINÆ.

1. Antennæ situated near the oral margin. 2
Antennæ situated near the middle of the head in profile. . . 3
2. Third joint of the antennæ forked, complicated in structure (*Chauna* preoc. West Indies). . . . . Neochauna, nom. nov.
Third joint of the antennæ elongate, with a distinct style, not forked (Central and South America). . . Acanthina Wiedemann.
3. Scutellum ending in a stout spine (Central and South America).
Cynipimorpha Brauer.
Scutellum without spine, simple. . . . Pachygaster Meigen.

15. ACANTHOMERIDÆ.

Very large, the largest among diptera, stout, bristleless, nearly bare flies. Eyes large, contiguous in the male. Ocelli present. Third joint of the antennæ complex, composed of seven segments, with a terminal, often in the male setiform style. Proboscis short, not adapted for piercing, with fleshy labella. Tegulæ rudimentary. Tibiæ without spurs; pulvilli and empodia pad-like. Wings with two submarginal and five posterior cells, the fourth posterior cell and the anal cell closed.

But two genera are known in this family, including altogether only about fifteen or sixteen species, all of which are inhabitants of Central and South America. The species are remarkable for their extraordinary size, some reaching nearly two inches in length. The species of *Acanthomera* are found in forests, alighting on trunks of trees, according to Mr. Champion; otherwise their habits, whether of the adult or immature stages, are but little known. Brauer has figured and described the larvæ of *A. Frauenfeldii*. They are cylindrical, thick and short. The last segment is firmly chitinized above with two series of hooklets, the two projecting backwards in the middle being stout and curved; below these there is a deep, transverse cleft, on the under side of which is a rounded lip.

In both *Acanthomera* and *Rhaphiorhynchus* the face may be produced conically or not at all. The two genera are distinguished by the structure of the palpi, in *Acanthomera* slender, in *Rhaphiorhynchus* stout and pointed. *Acanthomera* may have spines on the hind femora.

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16. TABANIDÆ.

Head large, transverse, somewhat flattened and with the occiput flat or concave. Antennæ porrect, the third joint composed of from five to eight annuli or segments. Eyes large, pubescent or bare, contiguous above in the male and with the

upper facets larger than the lower ones; in life usually with green and purple markings. Ocelli absent or present. Proboscis projecting, sometimes much elongated; palpi two-jointed, the second joint elongate or thickened. Thorax not very convex above; scutellum never with tubercles or spines on its border. Abdomen broad, moderately elongate or short, never slender or constricted; composed of seven segments; genitalia never prominent. Legs moderately stout, the tibiæ sometimes much dilated; middle tibiæ always with spurs at the tip; tarsi with three membranous pads at the tip (the empodia developed pulvilliform). Tegulæ always of considerable size. The marginal vein encompasses the entire wing; two submarginal and five posterior cells present; basal cells all elongate, the anal cell closed at or near the margin of the wing. Species never very small, often among the largest of the order, never thickly pilose, and wholly without bristles on body or legs.

This family includes the flies commonly known as horse-flies, and is widely distributed over the world. About fourteen hundred species are known, of which more than one hundred and fifty are from North America. Many of the species are conspicuous for their large size, though the greater number are of moderate size, but none are small. Most of them love the bright sunshine, though the smaller forms are more usually found about shady places near the border of woods, appearing on sunshiny days. The female alone is blood-sucking in habit; the males are much more rarely met with, and will be caught usually in sweepings of meadow-lands, on flowers, etc. Their power of flight is remarkable, moving as rapidly as can a horse. Their bites, though painful enough, do not seem to cause the same irritation as those of the mosquitoes and midges. When no better food offers, the females will, like the males, seek the juices of plants and flowers.

The spindle-shaped brown or black eggs of the Tabanidæ

are found attached to the stem of plants or on leaves, those of the aquatic forms are found attached to rushes. The larvæ are carnivorous, feeding upon snails, other larvæ, etc. They have a distinct head. The body is eleven-jointed, often encircled with retractile fleshy protuberances, sometimes developed only on the ventral side, the last segment with a vertical breathing opening, or the last two segments forming a stigmatic tube. Pupa free, living in the earth or in water.

TABLE OF GENERA.

1. Hind tibiæ with spurs at the tip, sometimes small (*Pangoninæ*). . 2
   Hind tibiæ without spurs (*Tabaninæ*). 7

2. Third joint of the antennæ composed of eight annuli, the first of which is only a little longer than the following ones. 3
   Third joint composed of five annuli, the first of which is much longer than the following ones; ocelli present. 6

3. Front of female broad, with a large denuded callus; ocelli present. 5
   Front of female narrow, ocelli present or absent. 4

4. First and fourth posterior cells closed (Central and South America).
   DICLISA Schiner.
   Fourth posterior cell, at least, open. . . *PANGONIA Latreille.

5. Eyes acutely angulated above; Hippoboscid-like species.
   GONIOPS Aldrich.
   Eyes not acutely angulated above; not Hippoboscid-like.
   APATOLESTES Williston.

6. Second joint of the antennæ about half as long as the first; eyes in life with numerous small dots. . . . . SILVIUS Meigen.
   Second joint of the antennæ as long or but little shorter than the first joint; wings with a dark picture: eyes in life with fewer, larger spots. . . . . CHRYSOPS Meigen.

7. Third joint of the antennæ without, or with a rudimentary basal process. 8
   Third joint of antennæ with a well-developed basal process. . 10

8. Thorax and abdomen with irridescent tomentum; all the tibiæ dilated (Central and South America and West Indies). HADRUS Perty.
   Thorax and abdomen without tomentum. 9

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* Inclusive of *Corizoneura* and *Diatomineura* Rondani.

9. Front of female as broad as long, the callus transverse.
HÆMATOPOTA Meigen.
Front of female narrow. . . . DIACHLORUS Osten Sacken.

10. Front tibiæ much dilated; process of the third joint much elongated (Central and South America). . . . STIBASOMA Schiner.
Front tibiæ not dilated. 11

11. First antennal joint elongate; body elongate (Central and South America). . . . . DICHELACERA Macquart.
First antennal joint short; body not elongate. 12

12. A small ocelligerous tubercle present in the male; eyes pubescent.
THERIOPLECTES Zeller.
No ocelligerous tubercle. 13

13. Eyes pubescent. . . . . ATYLOTUS Osten Sacken.
Eyes bare. . . . . TABANUS Linne.

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17. ASILIDÆ.

Species of moderate to large size, usually more or less elongate in form, sometimes thickly hairy; always bristly, the bristles usually conspicuously strong; highly predaceous in habit. Head flattened, broad and short, separated from the thorax by a freely movable neck. Front excavated between the eyes, the eyes in both sexes separated. Three ocelli present, usually situated upon a rounded tubercle; front with bristles. Antennæ porrect, simple, composed of three joints, the third usually more or less elongated, and with or without a terminal style or bristle, the style sometimes thickened and forming one or two apparent antennal joints. Proboscis never elongated, firm and horny, adapted for piercing, directed forward, or forward and downward; palpi composed of one or two joints; labella not fleshy. Abdomen composed of eight segments, the hypopygium or oviduct usually prominent. Legs strong, bristly, of moderate length, rarely somewhat elongated; tarsi strong; empodia bristle-like, the pulvilli rarely rudimentary. Tegulæ small. Wings when at rest lying parallel over the abdomen; basal cells long; two or

three submarginal and five posterior cells always present; first and fourth posterior cells and the anal cell open or closed.

The family Asilidæ or Robber-flies is one of the largest and best known among diptera, including nearly three thousand species, distributed among about one hundred and fifty genera. Many of the species are conspicuous for their large size, the largest measuring nearly two inches in length, while the smallest known species are seldom less than a third of an inch. They are the most predaceous of all flies in their habits. The greater part of them rest upon the ground, and fly up when disturbed, with a quick buzzing sound to alight again a short distance beyond. Some of the Laphrinæ have a striking resemblance to large humble bees, and are usually observed resting upon foliage about the borders of forests. All their food, which consists wholly of other insects, is caught upon the wing; their luckless victims when once seized in their strong feet are powerless to escape. Other flies and Hymenoptera are usually their food, but flying beetles, especially the Cicindelidæ are often caught and they are known to seize and destroy large dragon flies. In an instance that the writer observed, a female seized a pair of her own species, and, thrusting her proboscis into the thorax of the male, carried them both off together.

The larvæ live chiefly in rotten wood, under bark, or in soil containing decomposing vegetable matter, under leaves, etc., and feed upon grubs and other larvæ. The larvæ are cylindrical in shape, with parchment-like skin, the abdominal segments sometimes girdled with rounded tubercles, or with abdominal protuberances for locomotion. The pupæ are free, with strong hooklets at the anterior end, and the abdomen is provided with spiny girdles, mixed with hairs above and below; the last segment has two short divaricate hooklets and several smaller projections.

The young larvæ sometimes bore their way completely within the bodies of other larvæ, remaining there till their

food is wholly consumed. Frequently the larvæ are found free in the earth, however, where their transformation takes place. The eggs are laid about grass stems, or in the crevices of decaying trees infested by larvæ of other insects.

TABLE OF GENERA.

1. Marginal cell of wings open. 2
   Marginal cell closed. 3

2. Third joint of antennæ with an arista or aristiform style; abdomen slender; pulvilli wanting. . . . LEPTOGASTER Meigen.
   Antennæ not with an arista; usually with a thickened style. DASYPOGONINÆ.

3. Antennæ with a terminal bristle. . . . . ASILINÆ.
   Antennæ not with a terminal bristle. . . . . LAPHRINÆ.

DASYPOGONINÆ.

1. Front tibiæ with a terminal, claw-like spur. 28
   Front tibiæ not with a terminal, claw-like spur. 2

2. Pulvilli rudimentary or wanting. . . . ABLAUTUS Loew.
   Pulvilli normal. 3

3. Head narrow, about as high as broad; face narrow above, broader and swollen below, in large part covered with hair; large, elongate species. 4
   Head very obviously broader than high. 6

4. Antennæ with a terminal style. 5
   Third joint of antennæ long, without style; fourth posterior cell closed before the border of the wing; black species, with or without red on the abdomen. . . . . OSPRIOCERUS Loew.

5. Style about half the length of the third antennal joint. SCLEROPOGON Loew
   Style about a sixth or an eighth of the length of the elongated third joint. . . . . STENOPOGON Loew.

6. Fourth posterior cell closed before the border of the wing. . 7
   Fourth posterior cell wide open, rarely nearly closed. . . . 13

7. Antennæ much elongate, apparently composed of five joints. . 14
   Antennæ not elongate, composed of three joints, without terminal style. 8

8. Face bare, except on oral margin. 9
   Face pilose or hairy, more convex. 10

9. Anterior intercalary vein continuous or nearly so with the fourth vein, the last section of the latter oblique, closing or much narrowing the broad first posterior cell. . . . Microstylum Macquart.
Last section of the fourth vein continuous with the preceding section, the first posterior cell not closed or narrowed (Central and South America). . . . . Archilestris (Schiner) Loew.

10. Abdomen cylindrical, not narrow at the tip, elongate; near the proximal margin of the second and third segments with a white-pollinose, emarginate cross-band; wings dark. . . Dizonias Loew.
Abdomen less elongate, with five or six white-pollinose (interrupted or entire) cross-bands. 11

11. Scutellum with bristles; veins at the outer ends of the discal and fourth posterior cells parallel. . Orthoneuromyia Williston.
Scutellum without bristles; veins at the outer ends of the discal and fourth posterior cells not parallel. 12

12. First posterior cell open, scarcely narrowed; face broad. Laphystia Loew.
First posterior cell closed or much narrowed. . Triclis Schiner.

13. Antennæ elongate, composed of five joints; nearly bare species. 14
Antennæ less elongate or short, composed of three joints with or without a short or slender style. 15

14. First and second joints of the antennæ of nearly equal length, the third elongate, the fourth short, fifth elongate and densely pubescent; third and fourth not lobed at tip. . Ceraturgus Wiedemann.
First joint about three times the length of the second, third elongate, the fourth and fifth of nearly equal length; third and fourth joints at the tip with two lobes or processes, reaching to about the middle of the following joint. . . . . Myelaphus Bigot.

15. Style of antennæ short, thick, obtuse, not easily distinguishable from the third joint, or if so forming apparent joints; antennæ more or less elongate. 16
Terminal style small, more slender than the joint, apparent; antennæ shorter. 18

16 Nearly bare species; face flattened, bare, except below. Small or rather small species, shining or metallic black, with narrow or cylindrical abdomen and large wings. 17
Thickly pilose species, the bristles few and hair-like; antennæ springing from a convexity, the facial profile thence receding to the facial tubercle, which is situated upon the lower part of the face; abdomen short; head narrow. . . . . Dicolonus Loew.

17. All the tibiæ and the hind femora with short, strong setæ.
ECTHODOPA Loew.
Hind femora without such setæ. . . . DIOCTRIA Meigen.

18. Face distinctly swollen in profile, gibbose. 19
Face flattened or gently convex. 20

19. Thickly pilose species; the gibbosity of the face reaches to the base of the antennæ; anal cell usually open. . CYRTOPOGON Loew.
Thinly pilose, more pollinose species, the convexity of the face confined to the lower part; anal cell usually closed. LASIOPOGON Loew.

20. Abdomen elongate; front broad anteriorly, narrow behind.
PLESIOMMA Macquart.
Front not narrowed behind. 21

21. Hind tibiæ toward the tip and the hind metatarsi much thickened. 22
Hind tibiæ not, or but slightly, thickened toward the tip; metatarsi not thickened. 23

22. Head much broader than high, transverse, "goggle-like"; abdomen short, wings large. . . . . HOLCOCEPHALA Jaennicke.
Head only moderately broader than high, not at all spectacle-like in appearance. . . . . HOLOPOGON Loew.

23. Abdomen with thick, recumbent pile above; thickly pilose species; antennæ slender. . . . . PYCNOPOGON Loew.
Abdomen without such pile above. 24

24. Slender, nearly bare species; face perpendicular, straight or gently concave, narrowed above and bare, except on oral margin. . 25
Face gently rounded, not prominent below, in large part hairy and not or but slightly narrowed above. 26

25. Thickly whitish pollinose; abdomen flattened, usually reflected upward; third joint of antennæ and the style both slender.
STICHOPOGON Loew.
Less thickly pollinose; abdomen cylindrical, a little broader at the base; third joint of antennæ short and broad, the style minute.
See HABROPOGON BILINEATUS Will.

26. Large, elongate species, the style of antennæ short. CALLINICUS Loew.
Moderately large, and not much elongate species. . . . 27

27. Abdomen broader at the base, depressed; thorax much convex above; antennæ slender, the style long and slender (compare also species of Cyrtopogon). . . . . HETEROPOGON Loew.
Abdomen short, cylindrical; black, with bright golden opaque pollinose markings on thorax and abdomen.
See LAPARUS PICTITARSUS Bigot.

28. Face bare with bristles on the oral margin, in profile straight or concave, the oral margin most prominent. 29
Face convex below, the oral margin not prominent, more or less covered with hair. 31

29. Fourth posterior cell closed a considerable distance before the margin of the wing. 30
Fourth posterior cell open or closed in the margin. SARAPOGON Loew.

30. Hind pulvilli much shorter than the elongated claws; abdomen contracted toward the base (Central and South America).
BLEPHAREPIUM Rondani.
Hind pulvilli not much shorter than the claws; abdomen not contracted toward the base. . . . . DEROMYIA Philippi.

31. Third joint of the antennæ more or less dilated, the style very short.
LESTOMYIA Williston.
Third joint of antennæ slender, elongate. 32

32. Head broad and flat, the face not gibbose. 33
Face convex, densely covered with hair; thickly pilose species (Central and South America). . . . . LASTAURUS Loew.

33. Abdomen finely punctulate. . . . . TARACTICUS Loew.
Abdomen smooth, not punctulate. 34

34. Hind tibiæ at the tip and their tarsi thickened. 35
Hind tibiæ at the tip and their tarsi not thickened; fourth posterior cell wide open (Mexico). . . . COPHURA Osten Sacken.

35. Fourth posterior cell wide open; abdomen flattened, in the ♀ a little broader beyond the middle; in the ♂ near the tip, the last two segments of which are conspicuously silvery above.
NICOCLES Jaennicke.
Fourth posterior cell narrowed; abdomen of male not silvery above (*Blacodes* preoc.) . . . . . LOEWIELLA, nom. nov.

LAPHRINÆ.

1. Front tibiæ with a terminal claw-like spur. 2
Front tibiæ without claw-like spur. 4

2. Hind tibiæ thickened, club-like at the extremity; hind metatarsi thickened and elongate. 3
Hind tibiæ not clubbed; hind metatarsi of the usual structure (Central and South America). . . . . MEGAPODA Macquart.

3. Thorax projecting prominently in front over the head (Central and South America). . . . . PSEUDORUS Walker.
Thorax not projecting prominently in front (Central and S. America).
DORYCLUS Jaennicke.

4. Veins at the distal end of the discal and fourth posterior cells parallel or continuous in the same straight line. 5
   Veins at the distal end of the discal and fourth posterior cells not parallel or continuous. 8

5. Third joint of the antennæ with a terminal style, in length greater than the first two together; eyes not or but very slightly emarginate on the sides of the front, the front much wider above; scutellum without bristles, or with hair-like ones (West Indies and S. America.) ATONIA Williston.
   Third joint of antennæ without terminal style. 6

6. Third joint of the antennæ at least three times as long as the first two together; large species (Central and South America). APHESTIA Schiner.
   Third antennal joint less than twice the length of the first two together. 7

7. First joint of the antennæ about as long as the third; front much widened above, the eyes disciform and with enlarged facets in front; scutellum with weak bristles; body punctulate. CEROTAINIA Schiner.
   Third joint of the antennæ longer than the first two together; eyes on the sides of the front emarginate, the front not widened above; scutellum with bristles; first posterior cell usually narrowed; body punctulate. . . . . ATOMOSIA Schiner.

8. First posterior cell narrowed or closed. 9
   First postertor cell wide open. 11

9. Three submarginal cells present, i. e. the upper branch of the third vein is connected with the second vein by a cross-vein. POGONOSOMA Rondani.
   Two submarginal cells. 10

10. Hind femora of nearly equal thickness throughout; antennæ with a distinct terminal style; very large, robust, thickly pilose species. HYPERECHIA Schiner.
    Hind femora thickened toward the end; antennæ without terminal style; more elongate, less pilose species. . . NUSA Walker.

11. Thorax and abdomen nearly or quite bare; hind femora with spinous tubercles below. . . . . LAMPRIA Macquart.
    Thorax and abdomen pilose; larger species usually. . . . 12

12. Densely pilose species; the abdomen short, broad, usually broader beyond the middle; proboscis thick. . . DASYLLIS Loew.
    Less pilose, more elongate species; proboscis more elongate and slender. LAPHRIA Meigen.

ASILINÆ.

1. Bristle of antennæ plumose. . . . OMMATIUS Wiedemann.
Bristle not plumose. 2

2. The veins closing the discal and fourth posterior cells in the same straight line or parallel (Central, S. America). ATRACTIA Macquart.
The veins closing the discal and fourth posterior cells not parallel. 3

3. The posterior branch of the third vein curves forward to meet the costa before the tip of the wing. 4
The posterior branch of the third vein terminates beyond the tip of the wing. 5

4. Oviduct cylindrical, with a terminal circlet of spines. PROCTACANTHUS Macquart.
Oviduct laterally flattened, without circlet of spines. ERAX Macquart.

5. Two submarginal cells (Asilus sens. lat). 7
Three submarginal cells. 6

6. Abdomen shorter than the wings; body thickly pilose, claws obtuse. MALLOPHORA Macquart.
Abdomen longer than the wings; body thinly pilose. PROMACHUS Loew.

7. Oviduct laterally compressed. 8
Oviduct conical. . . . . .

8. Face without gibbosity, narrow throughout, not at all carinate, the mystax composed of a few long hairs. STENOPROSOPUS Loew.
Face with gibbosity, or not carinate or unusually narrow. . . 9

9. End lamellæ of the oviduct wedged in. . . EUTOLMUS Loew.
End lamellæ free, style-like. 10

10. Posterior border of the last ventral segment in the ♂ more or less widened. . . . . MACHIMUS Loew.
Posterior border (♂) not widened. 11

11. Legs prevailing shining yellow in color. . HELIGMONEURA Bigot.
Legs prevailing black, or light and opaque colored. . . . 12

12. Abdomen shining black above and below. - STILPNOGASTER Loew.
Abdomen not shining above and below. 13

13. Male genitalia club-like. . . . . NEOITAMUS Loew.
Male genitalia not club-like; the sixth and seventh segments take no part in the formation of the oviduct. . . . TOLMERUS.

14. Abdominal segments with bristles before the incisures. PHILODICUS Loew.
Abdominal segments without bristles before the incisures. . . 15

15. Bright colored large species. . . . . ASILUS Linne.
Small, ash-gray species. . . . . RHADIURGUS Loew.

18. APIOCERIDÆ.

Rather large, elongate, chætophorous, thinly pilose flies. Antennæ with a simple, short style. Front not excavated, broader in the female. Ocelli present. Face short. Proboscis with pseudo-tracheate labella. Third longitudinal vein of the wing usually furcate; basal cells large; five posterior cells present. Empodia wanting. Male forceps enlarged.

Less than a dozen species of this family are known throughout the world, six of which have been described from North America. The flies have much the appearance of large Therevids or Asilids, from which they will be at once distinguished by the anterior curvature of the outer veins of the wings. The larvæ are wholly unknown. For a discussion of the relationships of the family, as also a bibliographical list, see Kansas University Quarterly i, 101.

TABLE OF GENERA.

1. Palpi two-jointed, large; the second vein from the discal vein terminates beyond the tip of the wing. . . Apiocera Westwood.
   Palpi one-jointed, small; the second vein from the discal cell terminates before the tip of the wing. 2

2. Anal cell closed. . . . . Rhaphiomidas Osten Sacken.
   Anal cell open. . . . . Apomidas Coquillett.

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19. NEMISTRINIDÆ.

Species of moderate size, not elongate, thinly or densely pilose. Neuration complicated, the fourth and fifth veins are curved forward to terminate before the tip of the wing, the anterior cross-vein is obsolete, that is the third and fourth veins coalesce for a short distance; basal cells long. Antennæ small, short; third joint simple, with a terminal, slender, jointed style. Proboscis sometimes elongate. Ovipositor of the female elongate, often slender. Tibiæ without spurs;

empodia developed pulvilliform, but, with the pulvilli often minute.

Throughout the world about one hundred species of this family are known, the larger part of which are from South America and Australia. Only six species are known from North America and two or three from all Europe. Some of the species have the wings with numerous cross-veins, almost recticulate in appearance. *Megistorhynchus longirostris* from Africa, though only about two-thirds of an inch in length has a proboscis nearly three inches long. The flies are flower flies, resembling in their habiis the Bombyliidæ.

But little is known of the larvæ. The females of *Hirmoneura obscura* have been observed laying their eggs deeply within the burrows of *Anthaxia*, a wood-boring insect, in the pine rails of fences. The eggs were found in clusters and the young larvæ hatched from them differed very singularly from those of a more mature growth. They are more slender, but differ chiefly in having each of the abdominal segments from the sixth to the twelfth provided with a pair of false legs bearing a single elongate seta at the tip, the hooks pointing backward; on the thirteenth segment there are two pairs of similar setæ, the hooks of which, however, point forwards, thus enabling the larva to attach itself firmly and raise itself erect. These young larvæ issued in great numbers from the burrows in which they were hatched and, placing themselves erect, were blown away by the wind. Here for a time they have not been followed, but it is probable that they attach themselves by the aid of the ventral hooks to the bodies of large-sized beetles, by which they are carried into the ground when the female enters to deposit her eggs. This is probable from the fact that hundreds of pupæ and pupa skins were observed near the fence. On searching below these the larval skins were found at a depth of about two inches and still deeper were found the remains of the beetles, *Rhizotrogus solstitialis*, in some instances with the larvæ yet within them.

TABLE OF GENERA.

1. Proboscis short, protruding but little from the oral opening; eyes bare or pilose; two or three submarginal cells. HIRMONEUBA Meigen.

   Proboscis long, directed backwards; antennæ broadly separated; eyes bare; ovipositor of the ♀ composed of two slender lamellæ; three submarginal cells present. . . RHYNCHOCEPHALUS Fischer.

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20. MYDAIDÆ.

Rather large to very large, thinly clothed or bare, elongate flies. Neuration complicated, the basal cells long; the fourth vein always terminating at or before the tip of the wing. Antennæ elongate, the third joint flattened, with a terminal lamella. Front excavated between the eyes. Ocelli wanting. Proboscis short, with fleshy labella and without palpi (in our species). Empodia very little developed, not pulvilliform.

The family Mydaidæ comprises only about one hundred known species, but among them are the largest of the order, a few measuring two inches in length and rivaled only by the Acanthomeridæ among the other families of diptera. The larvæ of species of *Mydas* live in decaying wood, and it is probable that all the members of the family have similar habits. They are known to be predaceous in some cases upon the larvæ of beetles. The larvæ of *M. fulvipes* are nearly two inches in length, with swellings below the abdominal segments for locomotion; the body is depressed and somewhat widened, with the posterior extremity broader and obtuse. The pupa of *M. clavatus* has as its anterior end two strong, sharp, outwardly curved hooks; the first abdominal segment has, on its anterior border above, a row of very long, erect spines curved backward at the tip. Another series of spines is situated on the anterior border of the last segment, and, on the same segment there is a pair of hooks at the tip curved downward.

TABLE OF GENERA.

1. Terminal segment of the ♀ abdomen with a circlet of spines. . 2
   Terminal segment without circle of spines.* . MYDAS Fabricius.

2. A small cross-vein runs into the hind margin of the wing between the anal cell and the tip; hind tibiæ of ♀ with spurs.
   ECTYPHUS Gerstaecker.
   No such small cross-vein; hind tibiæ of ♀ without spurs at the tip.
   LEPTOMYDAS Gerstaecker.

21. BOMBYLIIDÆ.

Medium sized to small flies; often with abundant, long, delicate pile. Head as broad or narrower than the thorax, often spherical in shape, closely applied to the thorax. Eyes large, often contiguous above in the ♂ and rarely also in the ♀. Antennæ porrect, usually of but moderate length; third joint simple; style usually small and indistinct and sometimes wholly wanting. Ocelli present. Proboscis usually projecting from the oral cavity, and slender; sometimes elongate; at other times short, with broad labella. Abdomen composed of from six to eight segments, slender in a few genera only. Legs moderately long, weak, with short, weak bristles or spines. Pulvilli sometimes rudimentary, the empodia almost always so, the tarsi and claws small. Tegulæ small. Wings often with dark markings; two or more submarginal, three or four posterior cells present; discal cell present in all our genera; anal cell closed in or near the border of the wing, or narrowly open.

The family Bombyliidæ comprises about fifteen hundred known species. Most of them are swift flying insects, often

* "Generis *Ectyphi* proximum, differt: antennis elongatis, segmento penultimo cylindrico, ultimo, ♀, circiter duplo longiore, compresso, basi parum dilatato, apice obtuse acuminate ♀, duplo breviore, obtusiore, abdominis segmento ultimo inermi, cyathiformi, utrinque, parum dilatato. Long. c2o mm. undique niger, abdomine nitente, alis violaceo micantibus, extremo apice albidis—P. phyllocerus, Rocky Mts."
PHYLLOMIDAS Bigot.

hovering motionless in the air for a time and darting away like a flash. They seek sunny places in woodland roads, about blossoms or on rank vegetation. The Anthracinæ are a group especially characteristic of arid regions. In general the members of the family are prettily and delicately marked, and their life histories are often very interesting. In the adult state they are flower flies, feeding upon the pollen and honey deep within the blossoms, extracted by aid of their long proboscis. The larvæ of species of *Aphœbantus* and *Systœchus*, occurring in western America, are found in the egg-pods of the locust, *Caloptenus spretus*. "The larvæ begin to transform themselves into the pupa state early in the summer, and the pupa pushes itself half way out of the ground in order to disclose the fly. They continue to issue during the summer months. As a rule but one year is required for full development. Aphœbantus is first observed as a yellowish white grub, about half an inch long when extended, it being usually curved so that the head and tail nearly meet. It is usually found in a case of locust eggs which it has devoured, pushing the empty shells aside, and at last occupying the space where were twenty-one to thirty-six eggs. Often it is found in a little space below a number of egg-cases, as though it had feasted off the contents of several nests" (Riley). The larvæ of Anthrax have been found parasitic upon *Megachile*, *Osmia*, *Odynerus*, *Mamestra*, *Noctua* and *Agrotis;* those of *Argyramœba* upon *Pelopœus*, *Megachile*, *Cemonus*, *Osmia* and *Calicodoma*; those of *Bombylius* upon *Andrena* and *Colletes;* those of *Toxophora* upon *Eumenes;* those of *Callostoma* in the egg-cases of *Caloptenus italicœ*; those of *Systropus* upon *Limacodes*, etc.

TABLE OF GENERA.

1. The bifurcation of the second and third veins takes place opposite or nearly opposite the anterior cross-vein, the distance not exceeding the length of the cross-vein; the second vein forms a knee at its origin, the third vein in a straight line with the prefurca. . 2

The bifurcation of the second and third veins takes place at a greater distance from the cross-vein, usually at an acute angle. . . 13

2. Antennal style distinct, that is it is separated from the third joint or from the styliform prolongation of the joint by a distinct suture. 3
The third joint not with a distinct style separated by a suture, the style when present very minute. 8

3. Antennal style with a pencil of hairs at the tip; pulvilli distinct; front tibiae with bristles. 4
Antennal style not terminating in a pencil of hairs; three or four submarginal cells present. 5

4. Outer submarginal cell bisected by a cross-vein (*Spogostylum* Coquillett non Macquart). . . . . Coquillettia, nov.
Outer submarginal cell not bisected by a cross-vein, the anterior branch of the third vein sometimes connected with the second by a cross-vein (Argyramœba Schiner). . . Spogostylum Maequart.

5. Pulvilli distinct. . . . . Aldrichia Coquillett.
Pulvilli rudimentary or wanting 6

6. The outer submarginal cell divided by a cross-vein, making four submarginal cells. . . . . Hyperalonia Rondani.
The outer submarginal cell not divided by a cross-vein. . . 7

7. First posterior cell bisected near its middle by a cross-vein.
Exoptata Coquillett.
First posterior cell not bisected; posterior claws with a basal tooth.
Exoprosopa Macquart.

8. Eyes of male contiguous at the vertex; anal cell closed.
Astrophanes Osten Sacken.
Eyes of male not contiguous at the vertex; anal cell open. . . 9

9. Anal cell widest at its middle. 10
Anal cell widest at the margin. . . . . Mancia Coquillett.

10. The second vein strongly contorted at the end in the shape of a recumbent letter S; three submarginal cells present.
Dipalta Osten Sacken.
The second vein not strongly contorted at the end. . . . 11

11. Three submarginal cells normally present; proboscis elongate.
Stonyx Osten Sacken.
Two submarginal cells normally present. 12

12. The contact of the discal cell with the third posterior not much longer than its contact with the fourth posterior; proboscis long; sides of the abdomen with fringe of scales and not with hairs only.
Lepidanthrax Osten Sacken.

The contact of the discal cell with the third posterior at least twice as long as its contact with the fourth posterior, the latter contact often merely punctiform. . . . . ANTHRAX Scopoli.

13. Wings with three posterior cells. 39
Wings with four posterior cells. 14

14. First posterior cell closed. 15
First posterior cell open. 22

15. Three submarginal cells present. 16
Two submarginal cells. 17

16. Head broader than the thorax; posterior orbits not excised. PANTARBES Osten Sacken.
Head narrower than the thorax; posterior orbits excised. TRIPLASIUS Loew.

17. First basal cell longer than the second. 18
First basal cell not longer than the second. 21

18. Proboscis very short, not protruding beyond the oral margin; anal cell usually closed; large species (Cen. America). ANISOTAMIA Macquart.
Proboscis more or less elongate; anal cell open. 19

19. First posterior cell closed at some distance from the border of the wing. 20
First posterior cell narrowed, or closed in or near the margin of the the wing; small species (5-6 mm.) . THLIPSOGASTER Rondani.

20. Head comparatively small; the emargination of the occipal orbits almost imperceptible. . . . . BOMBYLIUS Linne.
Head broad; emargination of the occipital orbits distinct. HETEROSTYLUM Macquart.

21. Face thickly clothed with pile. . ANASTŒCHUS Osten Sacken.
Face sparsely clothed with pile. . . . SYSTŒCHUS Loew.

22. Two submarginal cells present. 27
Three submarginal cells present. 23

23. Bare species; tibiæ without bristles. . AMPHICOSMUS Coquillett.
More or less pilose species; tibiæ with bristles. 24

24. Antennæ as long as the head, the third joint not longer than the first two together. 25
Antennæ shorter than the head, the third joint twice as long as the first two together. . . . . EXEPACMUS Coquillett.

25. First antennal joint not thickened. 26
First antennal joint extraordinarily thickened. . PLOAS Latreille.

26. "Scutellum deeply sulcate longitudinally". GEMINARIA Coquillett.
Scutellum convex, not sulcate. . . . . LORDOTUS Loew.

27. Anal cell open. 30
Anal cell closed. 28

28. Proboscis short. . . . . Oncodocera Macquart.
Proboscis elongate. 29

29. Third joint of the antennæ with long bristly hairs; face with long hair. Acreotrichus Macquart.
Third joint of the antennæ without or with short bristly hairs above; face bare or shortly pilose. . . . . Phthiria Meigen.

30. Body clothed with more scales than hairs, gibbose; antennæ long, the first joint unusually long. . . . Lepidophora Westwood.
Body clothed chiefly with hair, or else nearly bare. . . . 31

31. Body more or less pilose; tibiæ usually bristly. . . . 32
Body bare; tibiæ bare or feebly bristly. 37

32. Both basal cells of equal length. . . . Sparnopolius Loew.
First basal cell longer than the second. 33

33. Third antennal joint but little longer than the first; mesonotum of male sometimes muriacate and the costa denticulate. Eclimus Loew.
Third joint of the antennæ more than twice the length of the first, bulbous at the base. 34

34. The origin of the second vein takes place before the proximal end of the discal cell at an acute angle. 35
The origin of the second vein is beyond the proximal end of the discal cell and is rectangular. . . . Desmatoneura Williston.

35. Third antennal joint scarcely longer than wide. Eucessia Coquillett.
Third antennal joint much longer than wide. 36

36. Face projecting in profile. . . . . Epacmus Osten Sacken.
Face retreating. . . . . Aphœbantus Loew.

37. Ocellar tubercle situated near the hind edge of the front. . . 38
Ocellar tubercle situated near the middle of the front. Metacosmus Coquillett.

38. Antennæ elongate, third joint flattened, the style flattened and composed of two distinct segments. . . Desmatomyia Williston.
Antennæ not elongated and with a distinct bisegmentated style. Paracosmus Osten Sacken.

39. Slender, elongate species. 40
Shorter, more thick-set species, the abdomen never cylindrical. 41

40. Females holoptic like the males; abdomen enlarged at its extremity. Systropus Wiedemann.
Females dichoptic; abdomen cylindrical, not enlarged at the extremity. Dolichomyia Wiedemann.

41. Three submarginal cells. 42
Two submarginal cells. . . . . GERON Meigen.

42. Body clothed with more scales than hairs; abdomen decumbent; antennæ long. . . . . TOXOPHORA Meigen.
Body clothed chiefly with hair; abdomen not decumbent.
RHABDOPSELAPHUS Bigot.

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22. THEREVIDÆ.

Rather small or moderate sized, elongate, bristly, sometimes pilose, predaceous flies. Eyes of the male contiguous; front in the female not excavated. Antennæ composed of three joints, the third simple, with a terminal style, sometimes wanting. Proboscis projecting, the labella broad. Ocelli present. Abdomen elongate; genitalia moderately or but little prominent. Legs with bristles; empodia wanting. Third longitudinal vein of the wings furcate, the posterior branch terminating beyond the tip of the wing; five posterior cells, anal cell closed toward the margin of the wing.

This family comprises only about two hundred known species, with but few genera broadly distributed over the world. The flies resemble the Asilidæ somewhat, and have habits not dissimilar, though much less active. The proboscis has fleshy labella, instead of the horny tip of the Asilidæ, and the legs are less stout—in many species they are easily broken off when captured. Their food is chiefly other diptera, for which they lie in wait upon leaves and bushes, or upon the bare ground. The larvæ have a short, eyeless, nonretractile head, the antennæ small and short. The body is slender and snake-like, showing apparently nineteen segments. Anterior spiracles situated at the end of the first segment behind the head; posterior spiracles on the apparently seventeenth segment. The larvæ live in the earth and decomposing wood, or in sand, feeding upon other insects or upon vegetable matter, ordure, etc. The pupæ are free; they have in front laterally projecting spinous points.

TABLE OF GENERA.

1. First posterior cell entire, not intersected by a cross-vein. . . 2
"First posterior cell divided by a cross-vein into two cells; first antennal joint unusually large." . . . METAPHRAGMA Coquillett.

2. Head much broader than long. 3
"Head not as broad as long, vertical diameter of eyes equaling their horizontal diameter; first joint of anteunæ unusually large and polished". . . . . NEBRITUS Coquillett.

3. Third joint of antennæ short, the first thickened. . TABUDA Walker.
Third joint of antennæ as long or but little shorter than the usually slender first joint. 4

4. Face bare or pubescent. . . . . PSILOCEPHALA Zetterstedt.
Face pilose. 4

5. Fourth posterior cell closed.. . . . . THEREVA Latreille.
Fourth posterior cell open. . . . . DIALINEURA Rondani.

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23. SCENOPINIDÆ.

Flies of moderate or small size, black in color and bare. Front not excavated; face bare, short and broad. Antennæ approximated at the base, the first two joints short, the third elongated, simple, without style or arista. Proboscis concealed; palpi cylindrical, bristly at the tip. Ocelli present. Males usually holoptic. Thorax rather long, moderately convex, though apparently much so from the low position of the head. Scutellum broad and short, without spines or tubercles. Abdomen flattened, more or less elongated, composed of seven segments. Tegulæ small. Empodia wanting. Third longitudinal vein of the wing furcate; basal cells long, the first much longer than the second; three posterior cells, the first narrowed in, or closed before the margin; anal cell closed.

The larvæ resemble closely those of the Therevidæ. They are very long and slender, having apparently nineteen segments, due to each of the abdominal segments except the last being divided by a strong constriction. The larvæ have been

found in decaying fungi and wood and under carpets or in furniture, and are supposed to be carnivorous. The flies are not very active in their habits, and because of the frequency with which they are observed on window-panes are usually called window-flies.

TABLE OF GENERA.

First posterior cell narrowed; legs rather stout. SCENOPINUS Latreille.
First posterior cell closed before the margin of the wing; legs slender (Mexico). . . . . PSEUDATRICHIA Osten Sacken.

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24. ACROCERIDÆ.

Small to large, never elongate, pilose or nearly bare flies. Head small or very small, chiefly occupied by the large eyes, which are usually contiguous in both sexes above or below, or above and below the antennæ; two, three or no ocelli present; antennæ composed of two or three joints, with or without a terminal arista or style. Proboscis rudimentary or long, sometimes very long. Thorax large, spherical; tegulæ very large and inflated; scutellum large. Abdomen closely united to the thorax, large and inflated. Legs rather stout; the tarsi with three membranous pads under the claws. Neuration variable, the veins sometimes weak and indistinct.

This family, the Acroceridæ or Cyrtidæ, comprises a small number of curious flies with curious habits. They are easily recognizable by their small head and large, inflated tegulæ. No family characters can be drawn from the neuration, owing to the great differences often existing between forms otherwise related. In the few forms in which the larvæ are known they are all parasitic upon spiders or their cocoons. "In the spring of 1887, while hunting for spiders, I found hanging in cobwebs several soft white maggots and pupæ. The webs were generally old and out of repair, and a closer examination showed that there no living spider was in them, but almost every one had an empty skin of a common spider *Amaurobius*

sylvestris, nearly full grown. The skin of the legs and thorax were not clean like a moulted skin, but dirty and opaque, as though eaten out, and the skin of the abdomen when present was torn and shriveled. From this I concluded that the maggots came out of the spiders, and from their size must have nearly filled them. The maggots varied considerably in size, the largest being a quarter of an inch long, while others were not more than half as large. The hinder half of the body was thicker than the front half and nearly spherical. They hung head downward, holding to the web by their jaws and were also partly supported by threads under and around them." The author of the foregoing, J. H. Emerton, reared from other specimens of these larvæ a fly belonging to the genus *Acrocera*. The larvæ of *Astomella Lindelii*, according to Brauer, are so lodged in the abdomen of the spider that the posterior terminal stigmata are in relation with the lung-tubes of the spider. The eggs are said to be deposited on dried twigs.

TABLE OF GENERA.

1. Antennæ with a terminal bristle. 3
   Antennæ without terminal bristle or style. 2
2. Antennæ short, third joint rounded, with terminal bristly hairs. . 3
   Antennæ elongate. 7
3. Antennæ inserted near the mouth. 4
   Antennæ inserted toward the vertex. 6
4. Wings with a stout costal spur near the tip of the auxiliary vein. PTERODONTIA Gray.
   Wings without such spur; anal cell absent. 5
5. Proboscis rudimentary. . . . . ONCODES Latreille.
   Proboscis elongate, directed backwards (Central and South America). PHILOPOTA Wiedemann.
6. Venation complete; eyes pilose. . . . . OPSEBIUS Costa.
   Venation more or less obsolete; eyes bare. . . ACROCERA Meigen.
7. Proboscis rudimentary. 8
   Proboscis elongate. 9
8. Eyes bare (Mexico). . . . . APPELEIA Bellardi.
   Eyes pubescent. . . . . OCNÆA Erichson.
9. Ocelli wanting; large flies. . . . . LASIA Wiedemann.
   Ocelli present; moderately large flies. . . EULONCHA Gerstæcker.

25. LONCHOPTERIDÆ.

Small (2-4 mm.) slender, brownish or yellowish flies. Antennæ short, porrect; third joint simple, circular in shape, with a terminal bristle. Ocelli present. Scutellum with two bristles. Legs long, bristly; pulvilli very small; empodia wanting. Wings lancet-like, pointed; the three basal cells of moderate size and of nearly equal length; fourth longitudinal vein furcate and united with the fifth near the base; first longitudinal vein short, second and third not furcate; the anterior cross-vein lies near the base of the wing, in front of the middle of the second basal cell and is oblique in position.

There is but one genus in this family, *Lonchoptera*, the members of which are found, often in abundance, in the grass or upon stones along the margins of shady brooks. The larvæ are flat with long bristles on the first, second and last segments; posterior spiracles broadly separated on the last segment, short and tubular. Head not differentiated, the body composed of ten segments, the last one apparently composed of two. Pupæ enclosed in a puparium, orthorrhaphous.

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26. EMPIDIDÆ.

Small to moderately large, elongated, predaceous flies. Head small, more or less spherical, not closely applied to the thorax. Males holoptic or dichoptic, the front never excavated. Antennæ porrect, approximated at the base, composed of three simple joints, the first two of which are often small; third joint variable in shape, with or without a terminal arista or style. Face without mystax. Proboscis short or long, projecting forward, downward or backward. Ocelli present. Abdomen composed of from five to seven segments, male genitalia prominent and of complicated and variable structure; ovipositor projecting, pointed. Tegulæ small. Legs often with peculiar structural characters—the coxæ or femora elongated, the femora thickened and with spines below, the meta-

tarsi flattened, etc.; pulvilli present, the empodia usually membranaceous and linear. Neuration variable; the discal cell sometimes absent, the third longitudinal vein furcate or simple; three or four posterior cells present; anal cell often shorter than the second basal cell, closed before the margin of the wing*; sometimes wholly wanting.

The family Empididæ is a large one, including many genera and species. Most flies belonging here will be at once recognized, but there are some, especially those of the subfamily Tachydrominæ, which have such peculiar neuration that they are apt to lead the student astray; some may even be sought for among the smaller Muscids. The flies are all predaceous, though obtaining part of their food at times from flowers. Many species, especially those of *Empis* and *Rhamphomyia* often fly in swarms, dancing up and down over running brooks, in the shade of trees or about shrubbery. Very rarely do any species reach the length of ten millimeters, and some are not more than three in length.

The larvæ are cylindrical, with small swellings on the under side, from the mesothoracic segments, for locomotion. They are probably carnivorous and live in the earth, under leaves or other decaying vegetable matter. The pupæ are free, with two porrect points at the anterior end.

TABLE OF GENERA.

1. Anal cell closed in the border or narrowly open; body without macrochætæ. . . . . Hilarimorphinæ.
   Anal cell closed before the border when present. . . . 2
2. Anal cell wanting; when present the front femora shorter or but little longer than their coxæ. . . . . Tachydrominæ.
   Anal cell present; front femora much longer than their coxæ. . 3

* *Mythicomyia*, a genus of doubtful relationship, has the anal cell open. In *Hilarimorpha* it is closed in the margin. Both genera also differ from other Empididæ in being destitute of macrochætæ. Osten Sacken and Schiner locate the latter genus among the Leptidæ. If that view is accepted, *Mythicomyia* should probably accompany it.

3. Posterior basal transverse vein, i. e. the vein which limits the anal cell, parallel or nearly parallel with the hind border of the wing.
EMPIDINÆ.
Posterior basal transverse vein not parallel with the hind border of the wing. . . . . HYBOTINÆ.

HILARIMORPHINÆ.

1. Second vein very short, terminating in the first; discal cell present.
MYTHICOMYIA Coquillett.
The second vein terminates in the costa; discal cell wanting.
HILARIMORPHA Schiner.

HYBOTINÆ.

1. Third longitudinal vein furcate; first submarginal cell closed.
BLEPHAROPROCTUS Loew.
Third longitudinal vein simple. 2

2. Anal cell shorter than the second basal cell. 3
Anal cell as long or longer than the second basal cell. . . . 4

3. Third antennal joint conical; bristle terminal. LEPTOPEZA Macquart.
Third antennal joint ovate; bristle subdorsal. OCYDROMIA Meigen.

4. Origin of the second longitudinal vein nearer the humeral than the anterior cross-vein; wings usually spotted. . SYNECHES Walker.
Origin not nearer the humeral cross-vein; wings not spotted. . 5

5. Vein between the first and second basal cells indistinct. SYNDYAS Loew.
Vein between the first and second basal cells distinct. HYBOS Meigen.

EMPIDINÆ.

1. Third longitudinal vein furcate. 2
Third vein simple. . . . . RHAMPHOMYIA Meigen.

2. No discal cell. . . . . CYRTOMA Meigen.
A discal cell present. 3

3. Proboscis distinctly longer than the head. 4
Proboscis not longer than the head. 6

4. All the legs of nearly equal length; hind femora much thickened.
PACHYMERIA Stephens.
Hind legs longer than the others, their femora but little or not at all thickened. 5

5. Proboscis slender, directed backward or downward. . EMPIS Linne.
Proboscis moderately thickened, directed forward.
ITEAPHILA Zetterstedt.

6. Antennæ very short, apparently two-jointed, the third joint compressed, with a short, thick, unjointed style. . Hormopeza Zetterstedt.
Antennæ not very short, distinctly three-jointed; third joint awl or pear shaped or spherical, with a two-jointed terminal style or bristle. 7

7. Proboscis as long as the head, vertical; anterior metatarsi usually thickened in the ♀. . . . . Hilara Meigen.
8. Proboscis shorter than the head, horizontal; anterior metatarsi of the ♂ not thickened. . . . . Gloma Meigen.

TACHYDROMINÆ.

1. Third longitudinal vein furcate; discal cell present; anterior coxæ much elongate. 2
Third longitudinal vein simple; discal cell wanting. . . . 5

2. Front femora much thickened; two posterior veins arise from the discal cell. . . . . Hemerodromia Meigen.
Front femora not much thickened; three posterior veins arise from the discal cell. 3

3. Antennæ with a long terminal bristle. . . Ardoptera Macquart.
Antennæ with a short terminal bristle or style. 4

4. Sixth vein obsolete before reaching the margin. Clinocera Meigen.
Sixth vein not obsolete before reaching the margin; antennæ with a very short terminal style. . . . Synamphotera Loew.

5. Anal cell, or at least the posterior basal cross-vein, present; antennæ with a long terminal bristle. . . . Tachydromia Meigen.
Anal cell wholly wanting. 6

6. Front femora thickened. 7
Front femora not thickened. 8

7. Arista terminal. . . . . Tachypeza Meigen.
Arista subdorsal. . . . . Proneutisca Loew.

8. Arista terminal. . . . . Drapetis Meigen.
Arista dorsal. 9

9. Proboscis short, vertical; palpi broad. . . . . Stilpon Loew.
Proboscis slender; palpi narrow, slender. . Phoneutisca Loew.

27. DOLICHOPODIDÆ.

BY PROF. J. M. ALDRICH.

Small flies, never exceeding 7 mm. in length, almost always green in ground color, usually shining, more rarely dusted with gray or brown, sometimes pure yellow or almost black. As a family they are distinguished from their nearest allies by the absence of the cross-vein between the discal and second basal cells, these uniting to form a single cell.

Head about as wide as the thorax (much wider only in Psilopinæ), usually a little wider than high; the face bare, very wide to very narrow, or the eyes contiguous below the antennæ; front generally widening rapidly above (in *Diaphorus* the eyes sometimes contiguous above), with bristles on the vertex only. Posterior orbit with a well defined row of short, erect bristles (toward the mouth indistinct in Hydrophorinæ and some other genera); proboscis fleshy, short, retracted, rarely a little protruding; antennæ three-jointed, inserted more or less above the middle of the eyes, the first two joints never much elongated, the third commonly oval, but in several genera lengthened; arista dorsal, subapical, or completely apical. Thorax higher and longer than wide, with regularly arranged bristles on the dorsum; in some genera a well-marked flattened or concave area before the scutellum. Abdomen tapering, conical or a little compressed (in *Hydrophorus* and *Scellus* sometimes peculiarly small and retracted), without noticeable bristles in most genera; the male hypopygium usually prominent, varying greatly in form, and in the degree in which it is concealed in the abdomen. Coxæ generally short, legs in most genera of medium length, sometimes elongated, those of the male frequently developed into some ornamental structure; the front femora are thickened in a few genera. Wings usually hyaline, yet often with dark markings, which may take the form of a definite pattern, or may follow the veins indistinctly, or may be evenly diffused; in

some cases the males have small snow-white spots in the tip of the wing. Anal cell always very short.

This family perhaps surpasses any other natural group of animals in the variety of sexual ornaments possessed by the males. These are paraded before the females, as are similar ornaments in the peacock and turkey-cock. See "Courtship Among the Flies", American Naturalist, Jan. '94, p. 35. They may occur in almost any external portion of the body. In a careful examination of a large number of species, I have never found any two in which they are identical. I am acquainted with at least fifty different forms of tarsal modification alone, every one of which is distinctive of its species. Nevertheless some species seem to offer no noticeable sexual differences beyond the presence of the hypopygium in the male; even this is in some cases but little visible.

In adult life all are predaceous, capturing chiefly the minuter soft bodied flies, which they enclose within their soft labella, while extracting the juices; the larvæ are, as far as known, feeders on decaying vegetation.

The following table is designed solely to enable beginners to determine the genera of their specimens: it does not, therefore indicate anything about the natural relations of the genera to each other. It is based on male specimens only, since otherwise it must have included many obscure and difficult characters.

TABLE OF GENERA.

1. Fourth longitudinal vein with a widely divergent fork on the front side; or if not, the head wider than the thorax, face wide, and the front deeply excavated (Psilopinæ). 2
   Fourth vein simple or merely broken, front not excavated. . . 5

2. Fourth longitudinal vein not forked. . . Aptorthus Aldrich.
   Fourth longitudinal vein forked. 3

3. Tegular cilia black, third longitudinal vein curved gently back at tip, scutellum with four large bristles. . . . Psilopus Meigen.
   Tegular cilia pale, third vein distinctly curved forward at the tip, scutellum with two large and usually two small bristles. . . 4

4. Face wide, front deeply excavated. . Gnamptopsilopus Aldrich.
Face narrow, front scarcely excavated. . Leptorhethum Aldrich.

5. Fourth longitudinal vein bent forward, forming an apical cross-vein; posterior cross-vein very oblique, parallel to the margin of the wing. Plagioneurus Loew.
Posterior cross-vein nearly transverse, usually no apical cross-vein. 6

6. Hind metatarsi with large bristles above. 7
Hind metatarsi without large bristles above. 8

7. Face in male reaching the lower corner of the eye. Hygroceleuthus Loew.
Face in the male not reaching the lower corner of the eye. Dolichopus Latreille.

8. Hypopygium long, extending forward under the venter. . . 9
Hypogygium short, not extending forward under the venter. . 21

9. Arista short-plumose. 10
Arista pubescent or bare. 12

10. Fourth vein beyond the posterior cross-vein gradually convergent toward the third. . . . . Poecilobothrus Mik.
Fourth vein shortly before the tip quite suddenly bent toward the third.* 11

11. Hypopygium pedunculate, slender, without long, branching appendages Pelastoneurus Loew.
Hypopygium sessile, with long, branching appendages. Metapelastoneurus Aldrich.

12. Before the scutellum the posterior third of the thoracic dorsum is hollowed out, or at least flattened down to a plane. . . . 13
Before the scutellum convex as usual. 16

13. Hypopygium long, pedunculated. 14
Hypopygium short, sessile or nearly so. 15

14. Bristles of the thorax yellow. . . Aphantotimus Wheeler.
Bristles black. . . . . Medeterus Fischer.

15. Color of body yellow, sometimes with a little black. Neurigona Rondani.
Color of body chiefly metallic, sometimes dusted; legs very long. Dactylomyia Aldrich.

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* If with a marked concavity toward the apex, see Paraclius, in which the pubescence of the arista is rather strong.

16. The face of the male extends below the eyes, hanging down before the mouth, apron-like. . . . . Polymedon Osten Sacken.
The face of the male reaches as far down as the lower edge of the eye. 17
The face of the male does not reach so far as the lower edge of the eye. 18

17. Third antennal joint of the male rudimentary, the long arista with a disk at the end. . . . . Macellocerus Mik.
Antennæ of simple structure. . . Tachytrechus Stannius.

18. Third and fourth veins towards the tip parallel or nearly so. . 19
Third and fourth veins toward the tip distinctly convergent. . 20

19. First antennal joint bare above, third joint elongate in the male. Peloropeodes Wheeler.
First joint hairy above. . . . . Gymnopternus Loew.

20. The last segment of the fourth vein gradually approaching the third. Hercostomus Loew.
Last segment near the middle abruptly curving forward, then gradually resuming its former course, making a segment of a circle, the concavity outwards, and ending near the third vein. Paraclius Bigot.

21. Costal vein extending to tip of third vein, the latter part of the fourth vein evanescent or partially so. . . . Asyndetus Loew.
Costal vein extending to the tip of the fourth vein, which is of the usual strength. 22

22. Sixth vein wanting (minute species, not shining, the first vein reaching only a fifth of the length of the wing). . . . Achalcus Loew.
Sixth vein present, at least for a short distance. . . . 23

23. First antennal joint hairy above. 24
First antennal joint bare above. 29

24. Second antennal joint with a thumb-like projection fitting into the inner side of the third. . . . . Syntormon Loew.
Second antennal joint without such projection. 25

25. Fourth vein before the tip sharply curved toward the third, nearly reaching it at the margin. . . Metapelastoneurus Aldrich.
Fourth vein near the end parallel with the third or only moderately convergent. 26

26. Arista dorsal, third antennal joint of usual size, palpi of male large, face wide. . . . . Diostracus Loew.
Arista dorsal, palpi small, face very narrow. . Anepsius Loew.
Arista nearly or quite at the end of the large, pointed third joint. 27

27. Hind coxæ without erect hairs on the outer side, third and fourth veins near the tip convergent. . . . . Hypocharassus Nick
Hind coxæ with one or more erect hairs, third and fourth veins parallel, wings wide. 28

28. Scutellum with smaller hairs on the disk besides the marginal bristles. Lasiargyra Mik.
Scutellum bare, except for the bristles. . . Argyra Macquart.

29. Posterior third of thoracic dorsum, before the scutellum, concave or at least distinctly flattened. 30
Dorsum rounded as usual. 32

30. Bristles of thorax yellow. . . . . Chrysotimus Loew.
Bristles black, rarely brownish. 31

31. Fourth vein parallel with the third beyond the cross-vein, or nearly so. Xanthochlorus Loew.
Fourth vein converging toward the third beyond the cross-vein, either gradually or by a double curve. . . . . Go back to 15.

32. Wings elongate, the posterior cross-vein considerably beyond the middle, less than its length from the apex of the fifth vein (Hydrophorinæ). 33
Wings not elongate, cross-vein scarcely beyond the middle, more than its length from the end of the fifth vein (if less, the hind metatarsus shorter than the following joint). 35

33. Fore femora slender. . . . . Liancalus Loew.
Fore femora more or less incrassated, with spines below. . . 34

34. Spines of fore femora very short, thoracic dorsum without well marked pollinose lines. . . . . Hydrophorus Fallen.
Spines of fore femora long, dorsum with pollinose lines. Scellus Loew.

35. Outer appendages of the hypopygium long, filiform. Nematoproctus Loew.
Outer appendages not long and filiform. 36

36. Second antennal joint with a thumb-like projection along the inner side of the third (Synarthrus Loew). . . . Syntormon.
Not with such prolongation. 37

37. Eyes contiguous or nearly so below the antennæ. . . . 38
Eyes contiguous above the antennæ. . . Diaphorus Meigen.
Eyes closest together at the level of the antennæ, diverging above and below; middle legs of male distorted. . Campsicnemus Walker.
Eyes not approximated. 39

38. Pulvilli of male fore tarsi conspicuously enlarged. EUTARSUS Loew.
Pulvilli of male not enlarged. . . . CHRYSOTUS pt. Miegen.

39. Thorax bright green, abdomen yellow, with a good deal of silvery pollen. . . . . LEUCOSTOLA Loew.
Not so marked. 40

40. Face broad, the palpi large, reposing on the proboscis; small, pollinose species, with yellow antennæ. . . . THINOPHILUS Wahlberg.
Palpi of ordinary size or else projecting lamelliform, free from the proboscis. 41

41. The third longitudinal vein (in the male) keeps close to the second till near the tip of the latter, then makes a wide curve backward; the third and fourth veins farther apart than usual. LYRONEURUS Loew.
Wings of ordinary structure. 42

42. Third joint of antennæ in the male conspicuously long, awl-shaped, not wider at the base than the first joint, . . . RHAPHIUM Meigen.
Third joint long, lancet-shaped, wider at the base than the first joint. PORPHYROPS Meigen.
Third joint short, the tip sometimes drawn out into a point. . 43

43. Arista nearly or quite apical; fore pulvilli of male not enlarged. CHRYSOTUS, pt.
Arista dorsal or subapical; fore pulvilli of male elongated. DIAPHORUS, pt.
Arista dorsal, inserted quite near the base of the joint; pulvilli plain; abdomen of male slender, compressed. . . SYMPYCNUS Loew.

CYCLORRHAPHA.

28. SYRPHIDÆ.

Small to rather large flies. Head hemispherical, often elongated or produced in the lower part; as broad or a little broader than the thorax. Face moderately broad, bare or clothed with dust or short pile; excavated in profile under the antennæ and projecting below, or with a distinct convexity near the middle part, never with longitudinal furrows or lateral ridges, usually convex transversely, sometimes with a median ridge. Oral opening large; proboscis rarely much elongated. Front never excavated. Antennæ usually porrect and approximated at their base, three-jointed, usually with a dorsal arista. Eyes large, bare or pilose; in the male usually contiguous above. Ocelli always present. Thorax comparatively large and robust, moderately arched above. Tegulæ of moderate size. Abdomen composed of five or six visible segments, rarely with only four. Hypopygium usually not prominent. Legs usually of moderate strength. Macrochætæ rarely present in any part of the body; the body generally thinly pilose or bare, but sometimes clothed with thick pile. Wings comparatively large; third longitudinal vein never forked; marginal cell open or closed; the fourth vein terminates in the third at or before the tip; three posterior cells; basal cells large; anal cell always closed before the border of the wing; between the third and fourth longitudinal vein and nearly parallel with them, a false or spurious vein, nearly always present and *characteristic of the family.*

The family Syrphidæ is one of the most extensive in the order. Nearly twenty-five hundred species are known throughout the world and many new forms are constantly being added. They contain among them many of the brightest-colored flies,

and numerous specimens are sure to appear in any general collection of insects. None are injurious in their habits to man's economy and many are very beneficial. In their adult habits they all show a great uniformity. They are flower-flies and feed upon honey and pollen, loving the bright sunshine.

The larvæ are usually not very elongate, with firm, sometimes tough skin, the head-segments small and extensile, the head not distinctly differentiated. The external mouth-parts are either wholly wanting, with only a soft fleshy opening, or there are two or four outwardly directed hooklets. Antennæ short, small, one or two jointed and fleshy. Body smooth or provided with soft conical projections and bristles; below usually with seven pairs of abdominal feet. At the posterior end the body terminates in a more or less elongate tube, single or double, the stigmata. This tube sometimes forms a short, almost chitinized, tubercular projection on the dorsal part of the last segment; at other times it is very long, longer than the body, slender and composed of two joints, the one sliding within the other, like the joints of a telescope. In changing to the pupal condition, the larval skin contracts to form the pupal envelope, and the body becomes shorter, more oval and of a darker color, the elongated respiratory tube, in the "rat-tailed" species, being curved over the back. Unlike all the other Cyclorrhapha, except the Pipunculidæ, the frontal lunule is not used in springing off the cap to the puparium.

The habits of the larvæ are more variable than those of the adult flies. A large number live in decaying wood, or other vegetation, or in ordure, or decomposing animal remains. Some live in the stems of various plants, some in fungi. The larvæ of many species of the Syrphini are aphidophagous, crawling about on the stems of plants frequented by plant-lice and destroying them. Some live in ant's nests and may be parasitic; others in the nests of humble bees.

On account of the large number of genera and the conse-

quent length of the table of the North American genera, I have introduced at the close an auxiliary table or grouping of a considerable number of the genera which can be defined by decisive characters.

TABLE OF GENERA.

1. Antennæ with a terminal style. 2
   Antennæ with a dorsal arista. 4

2. Antennæ cylindrical, the first two joints elongated (*Ceria*).
   SPHYXIMORPHA Rondani.
   First two joints of the antennæ short. 3

3. Eyes bare, small species. . . . . PELECOCERA Meigen.
   Eyes pilose, larger species. . . . . CALLICERA Panzer.

4. Marginal cell of the wings closed and petiolate. 48
   Marginal cell open. 5

5. Anterior cross-vein of the wings distinctly before the middle of the discal cell, rectangular. 6
   Anterior cross-vein near or beyond the middle of the discal cell, often oblique. 55

6. Antennæ elongate. 7
   Antennæ short. 16

7. Dorsum of thorax with yellow lateral stripes; large species, the abdomen always with distinct yellow bands. CHRYSOTOXUM Meigen.
   Dorsum of thorax without yellow lateral stripes or margins. . 8

8. Face rounded, pilose, not tuberculate; oral margin not projecting. 9
   Face not evenly arched, tuberculate or the oral margin projecting. 14

9. Moderately large to large species; scutellum flattened, usually with spines or tubercles on its margin; a stump of a vein in the first posterior cell from the third longitudinal vein. 10
   Small species; scutellum without spines or tubercles; no such stump of a vein present. . . . . PIPIZA Fallen.

10. Abdomen much narrowed near the base (Central and S. America). 11
    Abdomen not or but little narrowed near the base. . . . 12

11. Face swollen and prominent below. RHOPALOSYRPHUS Giglio-Tos.
    Face not swollen and prominent below. . MIXOGASTER Macquart.

12. Second segment of the abdomen with the lateral margins inflated.
    OMEGASYRPHUS Giglio-Tos.
    Second segment of the abdomen normal. 13

13. Hind metatarsi much dilated. . . . . Ubristes Walker.
Hind metatarsi not conspicuously dilated. . Microdon Meigen.

14. Body clothed with sparse tomentum; all the femora thickened and with spinous bristles below (Central and South America and West Indies). . . . . Lepidostola Mik.
Body not with flattened tomentum. 15

15. Face tuberculate below, partly or wholly yellow; epistoma receding; face and front not wrinkled. . . . . Paragus Latreille.
Epistoma projecting; front and face black. . : . . 21

16. Face black in ground-color. 17
Face more or less yellow in ground-color. 26

17. Abdomen with only four visible segments; first two joints of the antennæ very short, third large, subquadrate, with a short, subterminal arista. . . . . Nausigaster Williston.
Abdomen with more than four visible segments. . . . 18

18. Hind femora distinctly thickened. 19
Hind femora but little or not at all thickened. 20

19. Scutellum unusually large, nearly square; males dichoptic.
Chalcomyia Williston.
Scutellum not unusually large, considerably broader at the base; males holoptic and with a facial tubercle. . . Myiolepta Newman.

20. Face rounded, not tuberculate, the oral margin not projecting.
Pipiza Fallen.
Face tuberculate or the oral margin projecting. 21

21. Epistoma projecting; small, black species. 22
Face tuberculate, the oral margin not projecting. . . . 23

22. Front in the female and usually the face in both sexes with transverse wrinkles; vena spuria obsolete. . . Chrysogaster Meigen.
Front and face not wrinkled; face pilose and not tuberculate.
Psilota Meigen.

23. Metallic green, metallic green and black, or black species; facial orbits separated by a slender parallel groove. . . Chilosia Meigen.
Black with more or less metallic green or blue, with yellow or yellowish cross-bands on the abdomen; face without parallel grooves. . 24

24. Wings not longer than the abdomen; ocellar tubercle large; abdomen depressed, long-elliptical, somewhat narrowed toward the base, the markings ferruginous or orange yellow. . Pyrophæna Schiner.
Wings longer than the abdomen; abdomen with yellow or greenish yellow or shining metallic cross-bands; usually elongate species. 25

25. Front tibiæ distally and tarsi of the ♂ dilated, those of the female slightly widened. . . PLATYCHIRUS St. Fargeau and Serv.
Front tibiæ and tarsi slender in both sexes. MELANOSTOMA Schiner.

26. Abdomen narrowed toward the base, in outline spatulate or club-shaped. 27
Abdomen oval or slender, not club-shaped or spatulate. . . 31

27. Third longitudinal vein deeply curved into the first posterior cell (Central and South America). . . . SALPINGOGASTER Schiner.
Third longitudinal vein straight or gently curved. . . . 28

28. Hind femora slender; front of female long, narrowed above. . 29
Hind femora thickened; abdomen less elongate; front not long and narrow above. 30

29. Alulæ rudimentary or wanting. . . BACCHINA Williston, nov.
Alulæ well developed. . . . . BACCHA Fabricius.

30. Epistoma produced anteriorly, the face in profile deeply concave from antennæ to tip; third joint of the antennæ rounded.
SPHEGINA Meigen.
Epistoma produced more downward, in profile gently concave; third joint of the antennæ not rounded. . . NEOASCIA Williston.

31. Front long, much narrowed above in the female; cheeks very narrow, the eyes approaching each other at the lower part of the head; wings usually with a dark picture; abdomen more or less elongate.
OCYPTAMUS Macquart.
Species without the above characters. 32

32. Dorsum of the thorax with yellow lateral margins. . . . 39
Dorsum of thorax not with yellow lateral margins. . . . 33

33. Abdomen with definite yellow cross-bands. 34
Abdomen not with definite yellow cross-bands. 42

34. Hind femora extraordinarily thickened. SYRITTA St. Farg. and Serv.
Hind femora slender. 35

35. Sixth abdominal segment in the ♂ as long as the two preceding together, cylindrical; fifth segment in the ♀ one-half as long as the preceding. . . . . EUPEODES Osten Sacken.
Sixth segment not peculiar, the fifth segment of the ♀ one-third or one-fourth as long as the preceding. 36

36. Front very convex; eyes of ♂ with an area of enlarged facets above.
CATABOMBA Osten Sacken.
Front not remarkably convex. 37

37. Third longitudinal vein with a distinct curvature into the first posterior cell; third joint of the antennæ elongate oval. DIDEA Macquart.
Third longitudinal vein straight or gently curved; epistoma not produced (if produced snout-like, *Rhingia*). 38

38. Males holoptic. . . . . Syrphus Fabricius.
Males broadly dichoptic. . . . . Chæmosyrphus Mik.

39. Dorsum of thorax with a median cinereous line; ocelli usually remote from the vertex. . . . . Mesogramma Loew.
Dorsum of thorax without such line. 40

40. Eyes of ♂ with an area of enlarged facets above; fourth segment of the abdomen with two median yellow stripes and oblique side-spots. Allograpta Osten Sacken.
Eyes of ♂ not with an area of enlarged facets above; fourth abdominal segment not so marked. 41

41. Face projecting below; slender species. Spilærophoria Macquart.
Face receding; abdomen oval. . . Xanthogramma Schiner.

42. Thickly pilose species; abdomen black, the basal portion light-colored. . . . . Leucozona Schiner.
Thinly pilose species, not so marked. 43

43. Hind femora thickened. 44
Hind femora slender. 47

44. Species wholly or chiefly reddish or lutescent. 46
Black species, sometimes with luteous spots on face, humeri, and basal angles of the abdomen. 45

45. Scutellum unusually large, nearly square in outline; males dichoptic. Chalcomyia Williston.
Scutellum oval; males holoptic. . . . Myiolepta Newman.

46. Face carinate; abdomen oval. . . . Brachyopa Meigen.
Face tuberculate. . . . . Hammerschmidtia Schummel.

47. Epistoma produced into a long porrected snout. Rhingia Scopoli.
Epistoma not produced. . . . . Chilosia Meigen.

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48. Third longitudinal vein bent deeply into the first posterior cell. 51
Third longitudinal vein not bent deeply into the first posterior cell; antennæ elongate. 48

49. Arista very densely plumose, appearing as a solid mass. Copestylum Maequart.
Arista feathery plumose. 50

50. Males dichoptic. . . . . Megametapon Giglio-Tos.
Males holoptic. . . . . Volucella Geoffroy.

51. Hind femora with a sharp tooth-like projection below near the distal end. . . . . Milesia Latreille.
Hind femora without such tooth. 52

52. Frontal triangle of ♂ strongly protuberant (*Doliosyrphus* Bigot, Central and South America). . . . . Priomerus Macquart.
Frontal triangle not prominent. 53

53. Epistoma produced into a long porrected snout (Central and South America). . . . . Lycastrirhyncha Bigot.
Epistoma not produced. 54

54. Thorax with distinct yellow markings; femora thickened; hypogygium enlarged (*Pteroptila*). . . . . Meromacrus Rondani.
Thorax without distinct yellow markings; hind femora sometimes thickened; hypopygium not prominent. . Eristalis Latreille.

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55. Arista plumose. 56
Arista bare or pubescent. 58

56. Antennæ elongated. . . . . Phalacromyia Rondani.
Antennæ short. 57

57. Thinly pilose; abdomen with yellow bands. Sericomyia Meigen.
Thickly pilose; abdomen without yellow. Arctophila Schiner.

58. Third longitudinal vein bent deeply into the first posterior cell; hind femora thickened. 59
Third vein only gently curved. 64

59. Face carinate; hind femora with an angular protuberance below near the outer end. . . . . Tropidia Meigen.
Face tuberculate or arched, not carinate. 60

60. Abdomen much narrowed at the base (Central and South America). Ceriogaster Williston.
Abdomen not narrowed at the base. 61

61. Antennæ elongate (Mexico and Europe). Platynochætus Wiedemann.
Antennæ short. 62

62. Thorax and scutellum densely pollinose above. Pterallastes Loew.
Thorax and scutellum not densely pollinose above. . . . 63

63. Third joint of the antennæ broad; thorax not vittate. . . 67
Third joint of the antennæ oval; thorax usually vittate. . . 64

64. Ocelli remote from each other. . . . Asemosyrphus Bigot.
Ocelli not remote from each other. . . Helophilus Meigen.

65. Thickly pilose species. . . . . Mallota Meigen.
Thinly pilose. 66

66. Hind tibiæ of the male with an internal median spur. (See also *Mallota* sp.) . . . . . TEUCHOCNEMIS Osten Sacken.
Hind tibiæ of ♂ not with such a spur. POLYDONTOMYIA Williston.

67. Hind femora thickened and with a bifid spur below (?North America). SENOGASTER Macquart.
Hind femora without such spur. 68

68. Slender species; abdomen narrowed basally. (See 28.)
Abdomen in no wise club-shaped. 69

69. Thorax with distinct yellow markings other than on the humeri. 78
Thorax not with distinct yellow markings of the ground color other than rarely on the humeri. 70

70. Face transversely arched or carinate, not produced, not tuberculate; abdomen more or less elongate and nearly bare. . . . 71
More or less thickly pilose species, often large. 73

71. Hind femora extraordinarily thickened; anterior cross-vein rectangular. . . . . SYRITTA St. Farg. and Serville.
Hind femora more or less thickened; cross-vein oblique. . . 72

72. Face sharply carinate. . . . . TROPIDIA Meigen.
Face transversely arched. . . . . XYLOTA Meigen.

73. Scutellum, margin of the thorax and pleuræ with bristly hairs. CHRYSOCHLAMYS Rondani.
Thorax wholly without bristles. 74

74. Face short, not produced, concave from antennæ to tip, not tuberculate; hind femora thickened. 75
Face produced, long. 76

75. Abdomen elongate. . . . . BRACHYPALPUS Macquart.
Abdomen very broad; thorax densely pilose; middle femora of the ♂ with an inferior basal spur. . . . HADROMYIA Williston.

76. Face produced forward, pointed, concave from antennæ to tip, not tuberculate; hind femora thickened. CRIOPRORA Osten Sacken.
Face not evenly concave, but tuberculate or convex. . . . 77

77. Third joint of the antennæ produced above into a conical process, terminating in the thickened arista. . . MERAPIOIDUS Bigot.
Third joint of the antennæ obliquely oval; hind femora rarely thickened. . . . . CRIORHINA Macquart.

78. Hind femora with a conical, tooth-like protuberance below near the distal end. . . . . SPILOMYIA Meigen.
Hind femora without such protuberance. 79

79. Antennæ inserted low down, near the middle of the head in profile; face not longer than the front. TEMNOSTOMA St. Farg. and Serv.
Antennæ situated high up, on a conical process; front short, face much produced downward; antennæ long or short. SPHECOMYIA Latreille.

AUXILIARY TABLE.

1. Marginal cell closed:
   - Copestylum, 4, 5, 8.
   - Milesia, 2, 7.
   - Meromacrus, 2.
   - Lycastrirhyncha, 2, 6.
   - Megametapon, 4, 5, 8, 10.
   - Priomerus, 2, 8.
   - Eristalis, 2, 5, 8.
   - Volucella, 4, 5, 8.

2. Third vein bent deeply into the first posterior cell:
   - Didea, 8.
   - Milesia, 1, 7.
   - Meromacrus, 1.
   - Lycastrirhyncha, 1, 6.
   - Ceriogaster, 1, 9.
   - Helophilus, 10.
   - Mallota, 8, 10.
   - Polydontomyia, 7.
   - Platynochætus, 4.
   - Salpingogaster, 9.
   - Priomerus, 1, 5, 8.
   - Eristalis, 1, 5, 8.
   - Tropidia, 7.
   - Pterallastes.
   - Asemosyrphus, 10.
   - Teuchocnemis.
   - Senogaster, 7, 9.

3. First posterior cell with a stump of a vein from the third longitudinal:
   - Mixogaster, 4, 9.
   - Rhopalosyrphus, 4, 9.
   - Ubristes, 10.
   - Omegasyrphus, 4, 8.
   - Microdon, 4, 8.

4. Antennæ elongate:
   - Sphyximorpha, 9.
   - Pipiza, 8.
   - Omegasyrphus, 3, 8.
   - Microdon, 3, 8.
   - Ubristes, 3, 10.
   - Paragus, pt. 8.
   - Megametapon, 5, 10.
   - Platynochætus, 2.
   - Sphecomyia, pt.
   - Chrysotoxum, 8.
   - Mixogaster, 3, 9.
   - Rhopalosyrphus, 3, 9.
   - Lepidostola.
   - Chrysogaster, pt.
   - Volucella, 1, 5, 8.
   - Spilomyia, pt. 7.
   - Copestylum, 1, 5, 8.
   - Phalacromyia, 5.

5. Arista plumose:
   - Chilosia, pt. 8.
   - Eristalis, pt. 1, 2, 8.
   - Arctophila.
   - Megametapon, 4, 10.
   - Copestylum, 1, 4, 8.
   - Brachyopa pt.
   - Sericomyia.
   - Volucella, 1, 4, 8.
   - Phalacromyia, 4.

6. Epistoma produced into a long porrected snout:
   - Rhingia.
   - Lycastrirhyncha, 1, 2.

7. Hind femora with a projection below:
   - Senogaster, 2, 9.
   - Spilomyia, 4.
   - Polydontomyia, 2, 10.
   - Tropidia, 2.
   - Milesia, 1, 2.

8. Eyes pubescent:
   - Syrphus, pt.
   - Microdon, pt. 4.
   - Megametapon, 14.
   - Mallota, pt. 2, 10.
   - Pipiza, 4.
   - Leucozona.
   - Eristalis, pt. 1, 4.
   - Copestylum, 1, 4, 5.
   - Chrysochlamys.
   - Didea, pt. 2.
   - Chilosia, pt. 5.
   - Chrysotoxum, 4.
   - Psilota.
   - Paragus, 4.
   - Catabomba.
   - Volucella, pt. 1, 4, 5.
   - Priomerus, 2. 1.

9. Abdomen spatulate or narrowed conspicuously at the base:
   - Sphyximorpha, 4.
   - Rhopalosyrphus, 3, 4.
   - Senogaster, 2, 7.
   - Baccha.
   - Spegina.
   - Ceria.
   - Mixogaster, 4, 3.
   - Ceriogaster, 1, 2.
   - Salpingogaster, 2.
   - Bacchina.
   - Neoascia.

10. Males dichoptic:
   - Pelecocera.
   - Rhopalosyrphus, 3, 4, 9.
   - Mixogaster, 3, 4, 9.
   - Omegasyrphus, 3, 4.
   - Ubristes, 3, 4.
   - Microdon, 3, 4, 8.
   - Chalcomyia.
   - Megametapon, 1, 4, 5, 8.
   - Asemosyophus, 2.
   - Helophilus, 2.
   - Mallota, pt. 2, 8.
   - Polydontomyia, 2, 7.
   - Chamosyrphus.

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29. CONOPIDÆ.

Thinly pilose or nearly bare, more or less elongated species. Head broad; front broad in both sexes; ocelli present or absent. Antennæ porrect, composed of three simple joints, the third with a dorsal arista or terminal style. Oral opening large; proboscis slender. Abdomen more or less elongated, often constricted toward the base. Basal cells of wing usually large, the third (anal) closed; three posterior cells, the first closed or much narrowed; no spurious vein.

About forty species of this family are known from North America. They are all flower-flies, not very quick in flight. Flies of some of the genera (*Conops, Physocephala* and *Tropidomyia*) have a curious resemblance to certain wasps, and yet more to the species of *Ceria* among the Syrphidæ. The genus *Stylogaster* is remarkable for the very long ovipositor of the female and the elongate proboscis in both sexes. The four known species are from Africa, North and South America.

So far as known, the larvæ of this family are parasitic upon adult hymenoptera (wasps and humble-bees) and orthoptera. The eggs of the female are laid directly upon the bodies of the bees or wasps during flight. The young larvæ burrow within the abdominal cavity of their host, and there remain, the posterior end directed toward the base of the abdomen, feeding upon the non-vital portions, until ready to transform into the mature fly, when they escape from between the abdominal rings of the insect. The larvæ of Conopidæ are oval or pear-shaped, with distinctly differentiated segments, which are capable of extension or contraction. The antennæ are wart-like, with two chitinous, ocellus-like rings at the extremity. The mouth-hooklets are strongly bent. On the last segment there are two, large, round or kidney-shaped stigmatic plates, arched like a watch crystal. The puparium is oval, with button-like, slightly projecting anterior stigmata and the posterior pair as in the larvæ. They remain within the body of their host during the winter.

TABLE OF GENERA.

1. Antennæ with a terminal style; proboscis directed forward, without median hinge; abdomen constricted toward the base. . . 2
   Antennæ with a dorsal or subdorsal arista. 4
2. Face with a median ridge, without λ-shaped grooves (Central and South America.) . . . . . Tropidomyia Williston.
   Face with a well-marked λ-shaped groove. 3
3. Femora and tibiæ not thickened or dilated, or, if so, the thickening regular; small cross-vein of the wings nearly opposite the tip of the auxiliary vein, and near the middle of the discal cell. Conops Linne.

Femora irregularly thickened toward the base, the tibiæ with irregular outlines; small cross-vein of wings near the outer third of discal cell. PHYSOCEPHALA Schiner.

4. Proboscis directed forward, not bent near the middle. ZODION Latreille.
Proboscis bent near the middle, the distal part folding back. . 5

5. Vertex with bristles; tibiæ spurred; face carinate, not grooved; ovipositor of female very long. . . . STYLOGASTER Macquart.
Vertex and tibiæ without bristles; face with X-shaped groove. . 6

6. Anal cell short; ovipositor elongate and folded beneath the abdomen. DALMANNIA Robineau-Desvoidy.
Anal cell elongate, acute. 7

7. Cheeks not as broad as the vertical diameter of the eye. ONCOMYIA Robineau-Desvoidy.
Cheeks as broad or broader than the vertical diameter of the eye. MYOPA Fabricius.

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30. PIPUNCULIDÆ.

Small, thinly pilose or nearly bare flies. Head nearly spherical, broader than the thorax, chiefly composed of the large eyes. Eyes in the male contiguous above, separated by the narrow front in the female. Face narrow. Antennæ small, short, three-jointed, the third joint oval or reniform, with a dorsal arista, often with a more or less elongated pointed process on the under side. Ocelli present. Proboscis small, concealed. Abdomen composed of six or seven segments, small, cylindrical; hypopygium thickened, more or less club-shaped; ovipositor usually elongate and folded under the abdomen. Legs simple; metatarsi elongated, tarsi broad, tibiæ without spurs; pulvilli present. Tegulæ rudimentary. Wings much longer than the abdomen; third longitudinal vein not furcate; basal cells well developed, the anal cell elongate, reaching to, or nearly to, the margin; first posterior cell narrowed in the margin; three posterior cells present; discal cell present in the known American species.

The flies of this small family are most commonly met with on flowers or in sweepings, and are readily distinguished by

their large, spherical heads. They are not active in flight, and are easily captured. The larvæ of this family are parasitic so far as is known, those of *Pipunculus fuscipes* having been observed by Boheman in the abdomen of *Thamnotettix* (*Cicadata*) *virescens*. They are elliptical, thick, depressed, narrowed at either end, naked, about three millimeters in length, and somewhat broader in the middle. The puparia are somewhat smaller, oval, obtuse at either end, shining, pitchy black.

But a single genus, *Pipunculus* Latreille, is known to inhabit North America.

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31. PLATYPEZIDÆ.

Small, thinly pilose or bare flies, especially characterized by the ornamentation or enlargement of the hind tarsi. Head hemispherical, as broad or broader than the thorax and closely applied to it. Face usually short and broad. Eyes bare, contiguous in the male, and in some genera in the female also. Ocelli present. Antennæ porrect, the first two joints short, the third somewhat elongate, circular, pear-shaped or conical, with a terminal arista. Scutellum without bristles. Abdomen comparatively short, the male genitalia projecting in *Callomyia* only. Legs short and strong; hind legs more or less thickened and the hind metatarsi thickened or variously ornamented, the following joints often partaking in the peculiar structure. Wings rather large; third longitudinal vein simple, the fourth sometimes furcate; basal cells small, the anal usually reaching to the margin; discal cell sometimes wanting.

The flies of this small family are often found dancing in the air in small swarms or running about on the leaves of underbrush. The most remarkable thing connected with them is the extraordinary ornamentation sometimes seen in the hind tarsi of the males, which are always different in structure from those of the females. The flies are not often

met with and may be entirely wanting even in considerable collections of diptera. The larvæ live in mushrooms (*Agaricus, Lepiota*). They are flat, oval, with jointed, thread-like processes on the sides of the segments. The puparia are not very different from the larvæ.

TABLE OF GENERA.

1. Discal cell present. 2
   Discal cell wanting; fourth longitudinal vein furcate.
   PLATYCNEMA Zetterstedt.

2. Fourth longitudinal vein simple. . . . . CALLOMYIA Meigen.
   Fourth longitudinal vein furcate. . . . PLATYPEZA Meigen.

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32. PHORIDÆ.

Small, hunchback-like, nearly bare species. Head small, flattened; face very short, oral opening large. Front broad in both sexes; ocelli present. Antennæ apparently one or two-jointed, the terminal joint round, with a dorsal or apical bristle. Abdomen rather short, narrowed posteriorly; genitalia of the male often prominent, in the female projecting. Coxæ elongate, the femora more or less, the hind pair often extraordinarily widened and flattened. Wings large; on the anterior part with two strong veins, reaching only a little beyond the middle, from which three to five weak veins apparently arise and run obliquely across the wing.

The small flies of this small family have a peculiar, hunchback appearance and are observed running about on fallen leaves, windows, etc. The larvæ are cylindrical, thinner in front than behind, and live in dead snails, insects, decaying fungi, vegetables, etc., and possibly in living insects.

TABLE OF GENERA.

1. Front entirely without bristles. . . GYMNOPHORA Macquart.
   Front with long bristles. 2

2. Middle tibiæ beset with bristles along the outer side. TRINEURA Meigen.
   Middle tibiæ with few or no bristles on the outer side. PHORA Latreille.

MUSCIDÆ

(In the widest sense).

This very large group, commonly known as the Muscidæ sens. lat. has been divided into numerous minor groups, which by many dipterologists have been accredited with family rank. The number and limits of these groups are the subjects of more or less difference of opinion among systematists. The constant tendency, not only in dipterology, but in all entomology, is to raise the rank of minor divisions with the increase of new forms, and most writers on diptera nowadays give the family termination of *idæ*, to most of the groups of this family or superfamily. This tendency has, however, been carried to an extreme by some recent writers. Whether or not they be considered as families or subfamilies, matters little so long as it is remembered that the distinctive characters have, in general, less morphological significance than among the groups of the Orthorrhapha.

Brauer divides the group, which he calls Schizophora, after Becher, into the Eumyidæ and Schizometopa, which correspond pretty well to the old and well established Calyptratæ and Acalyptratæ, terms which should not, in my opinion be displaced at the option of any systematist who chooses to offer new terms. Nor can I accept the name Schizophora, the well established name of Muscidæ, or Muscidea, if one wishes a distinctive ending, is quite as good and more appropriate. That the change of limitations in a higher group gives the changer the right to change the names also, has no more forceful application here than among the lower groups. No one is sustained in rejecting generic names because he modifies the definition of the genus, as must necessarily be the case with nearly every added new species.

The following characters will apply to the family or superfamily in its entirety :

Muscidea.—Proboscis functional or rudimentary, in the former case usually short and with pseudotracheate labella, but sometimes elongate and adapted for piercing; palpi sometimes rudimentary, never jointed. Antennæ always three-jointed, the third joint simple, round, oval or elongate, compressed, and always (except *Cryptochætum*, where it is entirely absent) with a bare, pubescent or plumose, dorsal or subapical arista. Auxiliary vein sometimes rudimentary, often more or less coalescent with the first longitudinal vein, distinct in its entire course; never more than one submarginal and three posterior cells present, the marginal and submarginal cells aways open; Basal cells never large, the second basal cell sometimes coalescent with the discal cell, the anal cell present or absent; posterior cross-vein rarely absent. Pulvilli always present; empodia wanting; claws of the male often larger than those of the female.

The largest flies are found among the Calyptratæ, especially the Tachinidæ and Sarcophagidæ, but the largest do not equal the largest of the Orthorrhapha. Commonly the flies belonging to the Acalyptratæ are of moderate size or small, often indeed minute. The habits are of course very diverse, but by far the largest number live among rank vegetation, and are generally caught in sweepings.

The larvæ in a few forms are hatched from the eggs in the body of the parent fly; the pupæ are always inclosed in the contracted, hardened, larval skin, known as the puparium, the top of which is sprung off like a lid by the aid of the *ptilinum*, an inflatable organ pushed out through the frontal suture, which is characteristic of the group. In their habits, the larger part of those of the Calyptratæ are parasitic upon other insects, the Œstridæ upon warm-blooded animals. Many of the larvæ of the Sarcophagidæ, Muscidæ and Anthomyidæ live in decomposing animal matter or in living or decomposing vegetable matter as do also nearly all of the Acalyptratæ.

In the arrangement of the families, it will be observed that I have changed the order, placing the Calyptratæ last, an arrangement which I believe coincides better with the degree of specialization of the insects.

Very much remains to be done in the study of this wide group, not only in America, but throughout the world. As throughout the order, especial care should be taken in the identification of East Indian, Australian and African genera among the forms occurring in Central and South America and the West Indies. In the study of the Calyptratæ, especially the Tachinidæ, there has been an extraordinary activity during the past few years. I confess myself unable to straighten out the maze in which they seem to be. Professor Townsend has given to them the most and best study and is the best authority we have on their classification.

TABLE OF FAMILIES.

1. Tegulæ large; first posterior cell narrowed or closed; front of male always narrower than that of the female. 2
   Flies without all the above characters. 6

2. Mouth-parts rudimentary or wanting. . . . . ŒSTRIDÆ.
   Mouth-parts functional. 3

3. Arista of antennæ bare or very slightly pubescent. . TACHINIDÆ.
   Arista plumose or distinctly pubescent. 4

4. Arista bare on the distal part; dorsum of abdomen rarely bristly on the anterior part. . . . . SARCOPHAGIDÆ.
   Arista plumose or pubescent to the tip. 5

5. Dorsum of abdomen bristly; third joint of antennæ usually not elongated; legs usually long. . . . . DEXIIDÆ.
   Abdominal segments without bristles, except more or less near the tip; legs not elongated. . . . . MUSCIDÆ sens. str.

6. Tegulæ large; thorax with a complete transverse suture; first posterior cell* never narrowed; front of male narrower than that of the female. ANTHOMYIDÆ.

*In *Gastrophilus* (*Œstridæ*), the first posterior cell is not narrowed and the tegulæ are rather small; the genus will be distinguished by the rudimentary mouth-parts.

Tegulæ small; eyes of male not more approximated than those of the female, or, if so the narrowing is due to the less width of the median stripe, the borders remaining the same (*Muscidæ acalyptratæ*, *Holometopa* Brauer). 7

7. Auxiliary vein present, distinctly separated from the first longitudinal vein, terminating separately in the costa; the first longituninal vein usually terminates at or beyond the middle of the wing. . 8

Auxiliary vein absent, rudimentary or incomplete; the first longitudinal vein usually terminates before the middle of the wing. . . 22

8. A distinct bristle on either side of the face near the oral margin, i. e. oral vibrissæ present. 9

No oral vibrissæ. 13

9. Front on the sides and the vertex with long bristles. . . . 10

Bristles confined to the vertex or the front bare. . . . 12

10. The distance between the anterior and posterior cross-veins (on the fourth longitudinal vein) very much less than from the latter to the margin of the wing* i. e. the cross-veins approximated.

HETERONEURIDÆ.

Cross-veins not approximated. 11

11. Thorax flattened; head small; cheeks broad and bristly, the oral vibrissæ in consequence not markedly differentiated; bristly flies.

PHYCODROMIDÆ.

Thorax convex; head as broad or nearly as broad as the thorax; cheeks not markedly bristly. . . . . SCATOMYZIDÆ.

12. Abdomen elongate, narrowed at the base, usually cylindrical and decurved posteriorly; male genitalia usually prominent. SEPSIDÆ.

Abdomen comparatively short and broad; male genitalia but little or not at all prominent; costa of the wings usually bristly.

HELOMYZIDÆ.

13. Antennæ elongate and porrect; second joint as long or longer than the third, the latter usually with an angulated upper corner. . 14

Antennæ not elongated, or, if so, not porrect, the second joint always shorter than the third, the latter usually rounded at the end. 15

14. Head in profile triangular, the face remarkably retreating; hind tibiæ with or without a preapical bristle. . . . . ORTALIDÆ.

Head not triangular in profile, the face perpendicular or but little retreating; front with two lateral orbital bristles; hind tibiæ with a preapical bristle (*Tetanocerinæ*). . . . . SCIOMYZIDÆ.

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* The *Agromyzinæ* have the cross-vein approximated, but the auxiliary vein is wanting.

15. Femora thickened; hind tibiæ usually much dilated and with tubercles on outer side; basal cells large; first posterior cell narrowed; all the tibiæ with preapical bristle. . . . RHOPALOMERIDÆ.
Flies without the above characters. 16

16. Front bristly on the sides and at the vertex. 17
Front bristly at the vertex only; the auxiliary vein is not steeply inclined where it joins the costa. 20

17. Hind tibiæ, at least, with a preapical bristle. 18
Hind tibiæ without preapical bristle. 19

18. Basal cells of wings small. . . . . SAPROMYZIDÆ.
Basal cells of wings of moderate size and distinct. . SCIOMYZIDÆ.

19. Posterior basal cells of wings small, the anal cell never produced acutely; a single bristle on each side of the front (*Lonchæinæ*). . SAPROMYZIDÆ.
Posterior basal cells of wings of moderate size, the third (anal) often produced into an acute point. . . . . TRYPETIDÆ.

20. Legs elongate, often very long; abdomen narrow and long, often much narrowed at the base. 21
Legs not elongated; abdomen comparatively short, or, if long, not narrowed at the base. . . . . ORTALIDÆ.

21. First posterior cell narrowed in the margin or closed. MICROPEZIDÆ.
First posterior cell not narrowed in the margin, or but slightly so;* palpi rudimentary or wanting. . . . . SEPSIDÆ.

22. Eyes inserted at the tip of lateral processes. . . . DIOPSIDÆ.
Head not prolonged into lateral processes. 23

23. Hind metatarsi shorter than the following joint, incrassate. BORBORIDÆ.
Hind metatarsi longer than the following joint, not incrassate. . 24

24. Discal and second basal cells united, the separating cross-vein rudimentary or wanting; posterior cross-vein present.† . . . 25
Discal cell separated from the second basal cell by a distinct cross-vein, or, if not, the posterior cross-vein also wanting. . . 29

25. Legs long and slender; abdomen elongate and narrow. MICROPEZIDÆ.
Legs of moderate length, often strong; abdomen ovate or elongate elliptical. 26

26. Front bare, or, at the most, bristly at the vertex; third antennal joint rounded, or, if elongate, the head triangular in profile. OSCINIDÆ.
Front bristly at least as far as the middle; head never triangular in profile. 27

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* Compare here the *Psilidæ* when there is doubt regarding the auxiliary vein. † The posterior cross-vein is wanting in *Asteia* (*Drosophilidæ*), *Elliponeura* (*Oscinidæ*), *Phytomyza* (*Agromyzidæ*).

27. Anal cell wholly wanting; face usually large and arched, with the mouth opening large. . . . . EPHYDRIDÆ.
Face not arched, and the mouth opening never remarkably large. 28

28. Arista loosely and long plumose. . . . . DROSOPHILIDÆ.
Arista not plumose, or wanting. . . . . AGROMYZIDÆ.

29. Scutellum elongate, triangular, with protuberances or spines on its margin; femora thickened. . . . . RHOPALOMERIDÆ.
Flies without both the above characters. 30

30. Oral vibrissæ present. 31
Oral vibrissæ wanting. 35

31. Front bare or bristly at the vertex only (*Piophilinæ*). . SEPSIDÆ.
Front bristly at least as far as the middle. 32

32. Posterior cross-vein situated before the middle of the wing, the two cross-veins approximated. . . . . AGROMYZIDÆ.
Posterior cross-veins situated beyond the middle of the wing, the two cross-veins not much approximated. 33

33. Arista bare; body short and broad (*Milichinæ*). . AGROMYZIDÆ.
Arista pubescent or plumose, or, if bare, the abdomen elongate. 34

34. Arista with a few long hairs, mostly on the upper side. DROSOPHILIDÆ.
Arista thickly short plumose, pubescent or bare. . GEOMYZIDÆ.

35. Posterior basal and the anal cell of considerable size, distinct. . 36
Posterior basal and the anal cell small and indistinct. . . 37

36. Front bristly on the sides. . . . . TRYPETIDÆ.
Front bristly at the vertex only, or bare. . . . . PSILIDÆ.

37. Silvery white or whitish gray species, with unspotted wings; third antennal joint usually angulated on the upper angle. AGROMYZIDÆ.
Reddish yellow or brownish red species, often with spotted wings; third antennal joint rounded at the tip. . . . GEOMYZIDÆ.

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33. BORBORIDÆ.

Moderately large to small, black, brown or obscurely yellowish flies, having a quick, short flight. Head hemispherical; face obtusely carinate in the middle; vibrissæ present; front broad, usually bristly. Antennæ short; third joint rounded, the arista bare or pubescent. Second segment of the abdomen with a transverse depression; genitalia sometimes moderately

prominent. Wings absent in *Apterina;* auxiliary vein absent; all three basal cells complete. Legs moderately long and strong; hind metatarsi dilated and abbreviated.

The flies of this family are almost invariably found about decomposing organic matter. Those belonging to the genera *Borborus* and *Sphærocera* are observed often in clouds about dung and sewage, where their larvæ live. The small flies of the genus *Limosina* are observed about marshy places in company with Ephydrids.

The larvæ of *Borborus* are cylindrical and conical, with the skin roughened by erect, minute bristles; the antennæ are two-jointed, the mouth-hooklets developed. The posterior end has conical processes near the anus, and smaller tubercles about the spiracles; in *Limosina* the hind stigmata are elongated into a tube. The larvæ of *Limosina* live in algæ, fungi, diseased potatoes, etc.

TABLE OF GENERA.

1. Wingless species. . . . . APTERINA Macquart.
   Wings fully developed. 2

2. Fourth and fifth longitudinal veins incomplete beyond the discal cell, not reaching the border. . . . . LIMOSINA Macquart.
   Fourth vein at least, fully developed. 3

3. Scutellum with well-developed bristles; the fifth vein incomplete beyond the discal cell. . . . . BORBORUS Meigen.
   Scutellum without bristles; fifth vein complete. SPHÆROCERA Latreille.

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34. AGROMYZIDÆ.

Front broad, with or without bristles. Antennæ short, the third joint usually rounded, sometimes moderately elongate, or subquadrate; oral vibrissæ present, or absent. Arista wholly wanting (*Cryptochætum*) or, when present, bare or pubescent; never distinctly plumose. Genitalia rarely prominent. Wings broad; auxiliary vein rudimentary or indistinct, never distinctly separated in its whole length from the first

longitudinal vein; discal cell sometimes confluent with the discal cell (*Cryptochætum, Aulacigaster*), posterior cross-vein sometimes wanting (*Phytomyza*); anal cell present; cross-veins often much approximated (Agromyzinæ).

This family of small or minute flies, as here defined, includes the Agromyzinæ, Milichinæ and Ochthiphilinæ of Schiner, the Agromyzidæ and Phytomyzidæ of Loew. The group is somewhat difficult to define in such a way that the novice will always feel sure of his determinations. From the Drosophilidæ (or at least the known American species) it will be distinguished by the non-plumose arista. From the Ephydridæ, *Aulacigaster* and *Cryptochætum* will be distinguished by the presence of a distinct anal cell. From the Geomyzidæ it is difficult to distinguish some of the genera, especially of the Milichinæ and Ochthiphilinæ. The student would best consult the table of that family in cases of doubt. *Rhicnoessa* Loew is not included in the table: I can not define it.

The larvæ of *Phytomyza* are usually leaf miners. The larvæs of *Leucopis* feed upon plant-lice; those of *Ochthiphila* have been found in the galls of *Triticum repens*. The larvæ of *Agromyza* are elliptical in shape, the hind stigmata situated upon small, rounded plates on the under side of the last segment; the abdomen is provided with false legs, without bristles. The larvæ of *Leucopis* are cylindrical, thicker posteriorly, the skin roughened with short hairs; hind stigmata elongate, tube-like and widely separated; they creep leech-like, or like the geometrid larvæ.

TABLE OF GENERA.

1. Posterior cross-vein absent; oral vibrissæ present (*Phytomyzinæ*).
   PHYTOMYZA Fallen.
   Posterior cross-vein present. 2

2. Posterior cross-vein situated before the middle of the wing, the two cross-veins approximated. 3
   Posterior cross-vein at or beyond the middle of the wing, the two cross-veins not approximated; arista bare. 7

3. Second basal cell as long or but little shorter than the first. PHYTOMYZA Fallen.
Second basal cell distinctly shorter than the first (*Agromyzinæ*). 4

4. First posterior cell narrowed at the margin. . LEIOMYZA Meigen.
First posterior cell not narrowed at the margin, the third and fourth longitudinal veins nearly parallel. 5

5. Third antennal joint terminating in a spiny point. CERATOMYZA Schiner.
Third antennal joint does not terminate in a spiny point. . . 6

6. Third antennal joint rounded, of moderate size.* AGROMYZA Fallen.
Third antennal joint very large, subquadrate in shape. PHYLLOMYZA Fallen.

7. Second basal cell united with the discal cell. 8
Second basal cell separated from the discal cell by a small cross-vein. 9

8. Arista wholly wanting. . . . . CRYPTOCHÆTUM Rondani.
Arista present, bare; cross-veins remote, the anterior one situated near the base of the wing. . . . AULACIGASTER Macquart.

9. Oral vibrissæ present; abdomen short and broad (*Milichinæ*). 10
Oral vibrissæ wanting; the abdomen elongate oval (*Ochthiphilinæ*). 12

10. Costa with a deep incision before the tip of the first vein. LOBIOPTERA Wahlberg.
Costa not with such an incision. 11

11. Eyes round; mesonotum with bristles in the middle. MILICHIA Meigen.
Eyes oval; mesonotum with bristles on the sides only. CACOXENUS Loew.

12. Front with long bristles on the sides. . . OCHTHIPHILA Meigen.
Front without bristles on the sides. . . . LEUCOPIS Meigen.

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35. GEOMYZIDÆ.

Head rounded; face usually with vibrissæ; front broad, bristly below the vertex. Antennæ short, the third joint round or a little elongated, with a bare, pubescent or plumose arista. Wings comparatively long; auxiliary vein rudimentary; posterior basal cell and the anal cell present.

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* The genus *Desmometopa* Loew has never been described, but will be included in *Agromyza*; I do not know it.

This group, as here defined, includes the Geomyzidæ and Opomyzidæ and a part of the Heteroneuridæ of Loew. The insects included in it are always small, and sometimes minute. The larvæ of those few species of which the habits are known, live in the stems of various plants. The flies are almost always caught with the beating net.

TABLE OF GENERA.

1. Oral vibrissæ present. 2
   Oral vibrissæ wanting or indistinctly differentiated from hairs. . 7

2. Wings with bristles along the costa; bristles of antennæ plumose; second basal cell confluent with the discal cell.
   CURTONOTUM* Macquart.
   Flies not having the above characters. 3

3. Costal vein continuous about the wings; wings with markings; posterior cross-vein very oblique; arista pubescent. HETEROCHROA Schiner.
   Flies not having the above characters. 4

4. Mesonotum bristly in the middle on the posterior part only. . 5
   Mesonotum bristly in the middle on the front; arista pectinate on the upper side. . . . . BALIOPTERA Loew.

5. Under side of the front femora with bristle-like spines or strong bristles; arista pubescent. 6
   Front femora without such bristles; front with one proclinate and one divaricate bristle on each side. . . . DIASTATA Meigen.

6. Second longitudinal vein flexuous. . . . ISCHNOMYIA Loew.
   Second longitudinal vein not flexuous. . . . ANTHOMYZA Fallen.

7. Occiput flattened; wings spotted. . . . . OPOMYZA Fallen.
   Occiput convex; wings not spotted. . SCYPHELLA R. Desvoidy.

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36. OSCINIDÆ.

Small, bare species. Head hemispherical, face usually vertical in profile; oral border usually without vibrissæ; front broad, flat, sometimes with bristles at the vertex. Antennæ usually short; third joint usually rounded. Abdomen ovate or elliptical; genitalia hidden. Wings moderately or very

* This genus belongs more properly with the Drosophilidæ.

short; no auxiliary vein; third and fourth longitudinal veins parallel or divergent; posterior basal united with the discal cell; anal cell wholly wanting or rudimentary. Legs short; femora sometimes thickened; tibiæ without preapical bristle.

This group of flies is always sure to be represented by numerous specimens and species in any collection of diptera. The flies are very common and are collected in large numbers by the sweep-net, from rank growing grass and meadowlands. The larvæ of several species of *Oscinis* have been bred from wheat, barley, oats, rye and grass stems and *Phragmites;* those of *Oscinis* have similar habits; larvæ of *Siphonella* from *Cirsium*, etc. The larvæ are thick, cylindrical, with stout mouth-hooklets; abdomen with fleshy protuberances for locomotion; the antennæ two-jointed.

TABLE OF GENERA.

1. Head produced conically in front, the antennæ elongate.
   ECTECEPHALA Macquart.
   Head not produced conically; antennæ not elongate. . . . 2
2. The costal vein reaches to the tip of the third longitudinal vein. . 3
   The costal vein reaches to the tip of the fourth longitudinal vein. 5
3. No posterior cross-vein; first three longitudinal veins recurved.
   ELLIPONEURA Loew.
   Posterior cross-vein present. 4
4. Hind femora much thickened. . . . . MEROMYZA Meigen.
   Hind femora not thickened; mesonotum usually with stripes.
   CHLOROPS Meigen.
5. Ovipositor horny, subulate. . . . . OPETIOPHORA Loew.
   Ovipositor not horny and subulate. 6
6. Antennæ with a thickened, porrect, style-like arista.
   ELACHIPTERA Macquart.
   Antennæ with the usual bare, pubescent or rarely plumose arista. 7
7. Oral margin of the face produced; proboscis often elongate and folded back. . . . . SIPHONELLA Macquart.
   Oral margin not produced. 8
8. Third joint of the antennæ reniform, with a subterminal, short-plumose arista. . . . . GAURAX Loew.
   Third antennal joint rounded or oval. 9

9. Hind tibiæ with an elongated, curved spur: proboscis sometimes elongated and folded back. . . . . HIPPELATES Loew.
Hind tibiæ without spur. . . . . OSCINIS Latreille.

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37. DROSOPHILIDÆ.

Eyes not prominent; face vertical in profile, with vibrissæ at the oral margin, sometimes weak. Front with bristles at the vertex, not reaching beyond the middle; usually long. Third joint of the antennæ oval or rounded, the arista plumose or pectinated.* Abdomen usually short and broad, the genitalia not prominent. Auxiliary vein rudimentary; first longitudinal vein short, not reaching more than a third of the length of the wing; posterior basal cell united or not with the discal cell; anal cell usually present; posterior cross-vein sometimes wanting.

The species in this family are invariably small, of rather a plump appearance, giving a feeling of coldness to the fingers when grasped; the bristles of the head and legs are generally conspicuous, but the flies are without pile. The flies are often caught in beating and some species are especially abundant about decomposing, fermenting fruit, often observed in clouds. Following Schiner, I include in this family *Asteia* and *Sigaloëssa*, which are considered as representatives of a distinct family by Loew. The student will sometimes have difficulty in deciding whether his specimens should be located here or among the Ephydridæ, so closely do the two families run together.

TABLE OF GENERA.

1. Discal and second basal cells united. 2
Discal and second basal cells separated. 4

2. Posterior transverse vein wanting. . . . . ASTEIA Meigen.
Posterior transverse vein present. 3

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* The plumose or pectinated arista is characteristic of the known American genera but is not a family character.

3. Anal cell present. 5
   Anal cell wanting. . . . . Sigaloessa Loew.

4. Eyes prominent; wings straight. . . . . Phortica Schiner.
   Eyes not prominent; wings usually appearing as though broken and bent downward; larger sized species. . . Stegana Meigen.

5. Costa distinctly bristly; auxiliary vein distinct in its proximal part. Curtonotum Macquart.
   Costa not bristly. . . . . Drosophila Fallen.

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38. EPHYDRIDÆ.

Face more or less, often remarkably convex. Antennæ short; first joint small; antennal arista bare or pubescent or pectinated on the upper side. Oral cavity rounded, usually large; clypeus distinct, in some cases retracted into the oral cavity, in others prominent. Abdomen of variable form, composed of six segments in the males, seven in the females, sexual organs usually retracted. Auxiliary vein coalescent for the most part with the first longitudinal vein, distinct only at its proximal end; second basal cell confluent with the discal cell, the small vein separating them entirely absent, or scarcely visible (present in *Canace* Hal. only); anal cell imperfect and small (distinct in *Canace*); alulæ small.

The flies of this family are never large, often small or even minute. The greater number of the species are inhabitants of wet places, about marshy ground, meadows, etc. They are always thinly pilose or bare species, and never with bright colors. The exceedingly large head and mouth of some species are very characteristic, but in others this character is not so apparent and there is sometimes difficulty in separating the genera from those of the Drosophilidæ. The larvæ of many forms are very peculiar, resembling the rat-tailed larvæ of the Syrphidæ in many cases. The mouth, however, always has hooklets and the "tail" is forked at the end. The larvæ of species of *Notiphila* have been found in the stems of water plants; those of *Hydrellia* in the sap of trees, in the paren-

chyma of the leaves of *Lemna*, on *Alisma plantago*, etc.; those of *Pelina*, *Parydra* and *Ephydra* in water. Of especial interest are the habits of the larvæ of various *Ephydræ*, as the following account related to the writer by Prof. W. H. Brewer will show: "The waters of Lake Mono are clear, *very* heavy, have a nauseous taste, and when still the lake has a look as of oil and is not easily disturbed. The water feel slippery to the touch, and will wash grease from the hands or from clothes cold, more readily than common soap-suds will when hot. It is said that no fish or reptile lives in it, but it swarms with countless millions of larvæ that develop into flies which rest upon the surface of the water, as well as cover everything on the immediate shore. The numbers and quantities of these flies and larvæ are absolutely incredible. They drift up in heaps along the shore and *hundreds of bushels* could be collected. They only grow at certain seasons of the year, and then Indians come from far and near to gather them for food. The larvæ or pupæ are dried in the sun, the shell rubbed off by hand, when a yellowish kernel (pupa) like a small yellowish grain of rice appears. This is oily, very nutritious, and not unpleasant to the taste, and under the name of *koo-chah-bee* (so pronounced) forms a very important article of food. The Indians gave me some of it; it does not taste badly, and, if one were ignorant of its origin, it would make nice soup."

Another species, *Ephydra hians*, is found in equally great quantities in Lake Texcoco, near the city of Mexico, and Professor Penafiel has given the writer the following notes concerning them:

"It is of the eggs of this insect that the greater part of what is known as Ahuatle is composed and which is now used by the natives, who have preserved the customs of the ancient Aztecs. The eggs are cleaned and ground into flour, and are prepared by mixing with hen's eggs and fried with fat into small cakes. The larvæ are also used for food under the name of *Puxi*."

TABLE OF GENERA.

1. Second joint of the antennæ with a short spinous bristle at the anterior upper end. 2
   Second joint of antennæ without a spinous bristle at the anterior end. 8

2. The costal vein reaches to the tip of the third longitudinal vein. 3
   The costal vein reaches to the tip of the fourth longitudinal vein. 4

3. Tip of the abdomen in the male with elongated bristles.
   DICHÆTA Meigen.
   Tip of the abdomen in the male without elongated bristles.
   NOTIPHILA Fallen.

4. Abdomen broad. . . . . DISCOMYZA Meigen.
   Abdomen not broad. 5

5. Face on the upper part flat or gently convex, not carinate; third joint of the antennæ oval. . . . . PSILOPA Fallen.
   Face distinctly carinated above. 6

6. Cheeks narrow; eyes long. . . . . CLASIOPA Stenhammer.
   Cheeks broad, eyes round. 7

7. Clypeus prominent. . . . . ARTHYROGLOSSA Loew.
   Clypeus projecting but little beyond the oral margin.
   HECAMEDE Halliday.

8. Middle tibiæ with several long bristles exteriorly. PARALIMNA Loew.
   Middle tibiæ without long bristles exteriorly. 9

9. Oral opening small; eyes usually pubescent (*Hydrellinæ*). . . 10
   Oral opening large (*Ephydrinæ*). 16

10. Front femora thickened. 11
    Front femora not thickened. 12

11. Front femora much thickened; first posterior cell narrowed at the border of the wing. . . . . OCTHERA Latreille.
    Front femora moderately thickened; third and fourth veins parallel (West Indies). . . . . OCHTHEROIDEA Williston.

12. Eyes thickly but short pubescent. . . HYDRELLIA Desvoidy.
    Eyes sparsely pubescent or bare. 13

13. Sides of the face wholly without bristles. . HYADINA Halliday.
    Sides of the face with bristles. 14

14. Eyes wholly bare. 15
    Eyes sparsely pubescent; clypeus hidden. PHILHYGRIA Stenhammer.

15. Clypeus projecting; anterior part of mesonotum without bristles.
    PELINA Halliday.
    Clypeus hidden; anterior part of the mesonotum with bristles.
    PELOMYIA Williston.

16. Clypeus prominent. 17
Clypeus hidden. 18

17. The eostal vein reaches to the third longitudinal vein.
BRACHYDEUTRA Loew.
The eostal vein reaches to the tip of the fourth longitudinal vein.
PARYDRA Stenhammer.

18. Claws almost straight; pulvilli indistinct. . . EPHYDRA Fallen.
Claws curved; pulvilli distinct. 19

19. Oral border quite bare. . . . . ILYTHEA Halliday.
Oral border with bristles. 20

20. Arista pubescent. . . . . SCATELLA Desvoidy.
Arista pectinated. . . . . CÆNIA Desvoidy.

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39. DIOPSIDÆ.

Small species. Head prolonged into two lateral processes bearing the eyes; front bristly on the upper part only; no vibrissæ on the border of the mouth. Front femora thickened. Auxiliary vein much approximated to the first longitudinal vein.

But a single species of this family, *Sphyracephala brevicornis* Say, is known from North America, and it will be easily enough recognized by the singular eye-stalks. The habits, whether of the adult or larval stage are not known, nor are they known of any other member of the family, so far as I am aware.

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40. SEPSIDÆ.

Head rounded; front bristly above; face perpendicular or a little retreating; border of the mouth more or less hairy, with or without vibrissæ; proboscis short; antennæ not porrect, usually short. Abdomen narrowed at the base; hypopygium prominent. Auxiliary vein present or absent; all the basal cells distinct. Middle tibiæ with spurs; tibiæ usually without preapical bristle.

The flies belonging to this family are usually small, black

and elongated, with the abdomen narrowed at the base, thickened and curved downward toward the extremity; with transparent, irridescent wing, usually hyaline, but often with a spot or spots toward the end, and are usually observed about decaying vegetables, excrement, cheese, ham, etc., often in swarms. The flies for the greater part, run about actively and are quick in flight. The best known are the species of *Piophila*, the larvæ of which are so well known as "cheese-mites." These larvæ live in cheese, in ham or bacon, or in general in any fatty material, and often do much damage, being especially troublesome in pork-packing establishments. From the peculiar power of leaping possessed by the maggots they are often called "skippers"; the act is performed by the larvæ seizing with its extended mouth-hooklets the edge of the posterior truncature of the body and then suddenly releasing it while pulling hard. The larvæ are somewhat conical, pointed anteriorly, truncated behind, and about five millimeters in length. They are shining and smooth; the antennæ composed of two equally long joints; the mouth hooklets separated, short and divergent; the anterior spiracles whitish, the abdominal legs roughened, the anal segment with four fleshy prôtuberances. Puparium elliptic, rugose.

TABLE OF GENERA.

1. Head depressed; antennæ elongate. 2
   Head not depressed; antennæ not reaching beyond the oral margin. 3

2. Second joint of antennæ elongate, third oval. PROCHYLIZA Walker.
   Second joint short, third elongate. . . TYLOMYIA Giglio-Tos.

3. Auxiliary vein distinct; palpi rudimentary (*Sepsinæ*). . . . 4
   Auxiliary vein indistinct or wanting (*Piophilinæ*). 5

4. Front femora of the males with tubercles on the lower side.
   SEPSIS Fallen.
   Front femora of male without tubercles below. NEMOPODA Desvoidy.

5 Face elongate and truncate; ant-like in appearance. CEPHALIA Meigen.
   Face not elongate and truncate, but rounded. 6

6. Wings with a blackish spot at the tip; antennæ reaching nearly to the oral margin. . . . . MYCETAULUS Loew.
Wings wholly hyaline. 7

7. Proboscis long and slender, the labella folded back. MADIZA Fallen.
Proboscis short, the labella not folded backward; cross-veins of the wings approximated. . . . . PIOPHILA Fallen.

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41. MICROPEZIDÆ.

Front broad, bristly on the upper part. Face retreating in profile, sometimes very much so. Antennæ short or elongate, porrect. Abdomen elongate; genitalia in the male sometimes very large and complicated. Wings large; auxiliary vein present or not; anal cell always present; second basal cell closed, except in *Micropeza*. Legs long; tibiæ without preapical bristle.

The larvæ and their habits of this group are unknown. The flies are usually of considerable size and slender or very slender, with very long legs.

TABLE OF GENERA.

1. Third and fourth veins parallel. . . . . TETANURA Fallen.
Third and fourth veins not parallel, the first posterior cell narrowed or closed. 2

2. Third antennal joint more or less elongated. 3
Third antennal joint rounded. 4

3. Antennal arista apical and bare (West Indies, Central and S. America). NERIUS Schiner.
Antennal arista dorsal and plumose (Central and South America). CARDIACEPHALA Macquart.

4. Auxiliary vein wanting; second basal cell and the discal cell united. MICROPEZA Meigen.
Auxiliary vein present; second basal cell complete. . . . 5

5. Ultimate and penultimate sections of the fourth vein of nearly equal length; anal cell large. . . . . CALOBATA Meigen.
Ultimate section of the fourth vein twice the length of the penultimate section; anal cell small. . . . . TANYPEZA Fallen.

42. PSILIDÆ.

Front bristly on the upper part; broad. Face perpendicular or somewhat retreating in profile, without vibrissæ. Antennæ moderately or very long, decumbent. Abdomen rather slender; male genitalia but little prominent, the oviduct usually elongate. Wings large; auxiliary vein absent; third and fourth longitudinal veins parallel; all three basal cells distinct. Legs elongate; no preapical bristle on the tibiæ.

The flies of this family are of moderate size and elongate. The larvæ in those few species in which they are known live in the roots or galls of different plants. The larvæ of *Psila* are slender, cylindrical, pale yellow, bare; the posterior stigmata are small, rounded or button-like processes of a black color.

TABLE OF GENERA.

1. Antennæ much elongated, the third joint slender. LOXOCERA Meigen.
   Antennæ shorter than the face, the third joint oval or rounded. . 2

2. Face nearly perpendicular in profile; anal cell noticeably shorter than the second basal cell. . . . . CHYLIZA Fallen.
   Face retreating in profile; anal cell as long or longer than the second basal cell. . . . . PSILA Meigen.

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43. ORTALIDÆ.

Rather small to moderately large flies. Front broad in both sexes, never with lower fronto-orbital bristles. Vibrissæ wanting. Clypeus distinct, usually well developed; proboscis more or less stout; palpi broad, seldom narrow. Abdomen with five segments in the male, six in the female, the first two in both sexes more or less coalescent; male with a rolled-up, long penis; female with a three-jointed, horny ovipositor. Legs usually stout and short, never very slender. Venation of wings complete; auxiliary vein completely separated from the first longitudinal vein, though often much approximated to it; it runs into the costa at a more or less acute angle, without becoming indistinct at its end; posterior basal and anal

cell of considerable size, the latter exceptionally indistinct. Middle tibiæ alone provided with spurs; none of the tibiæ with an erect bristle before the tip exteriorly.

The present family includes a large number of species of flies that are sure to be represented in every collection of diptera. Many of the species have the wings prettily marked. The family by many entomologists is divided into several independent groups, as the Doryceridæ or Pyrgotinæ, the Platystomidæ, Ulidiidæ, etc. The flies are usually found about meadows or among luxuriantly growing grass. The larvæ are but poorly known.

TABLE OF GENERA.

BY PROF. W. A. SNOW.

1. First longitudinal vein beset with small bristles. 2
   First longitudinal vein bare. 5
2. Ovipositor flattened; ocelli present. 3
   Ovipositor not flattened; no ocelli. . . . . PYRGOTINÆ.
3. Third antennal joint round or short ovate; ends of auxiliary and first longitudinal veins widely separated. . . PTEROCALLINÆ.
   Third antennal joint not round or short ovate.* 4
4. Neither pro-pleural or sterno-pleural bristles present; third antennal joint elongate. . . . . PLATYSTOMINÆ.
   A sternopleural but no propleural bristle present. . CEPHALIINÆ.
5. Posterior angle of anal cell drawn out into a lobe, or at least, more or less acute; femora never armed. . . . . ULIDIINÆ.
   Posterior angle of anal cell obtuse, rounded or retracted; femora armed in most of the genera. . . . . RICHARDIINÆ.

PYRGOTINÆ.

Front strongly projecting; face retreating; oral opening small; proboscis not incrassated; clypeus but little developed; ocelli absent; no propleural bristle; first longitudinal vein hairy; ovipositor not flattened.

PYRGOTA Wiedemann.

PLATYSTOMINÆ.

Oral opening very large; clypeus generally very much developed, and the proboscis proportionately stout; third antennal joint elongate; meso-

* *Tetropismenus* Loew has the third antennal joint circular, but its short stigma or subcostal cell locates it among the Ortalinæ.

notum bristly on the hind part only; propleural and sternopleural bristles absent; female abdomen with five segments; ovipositor flattened; first longitudinal vein bristly.

1. The picture of the wings consist chiefly of a dark border along the costa, from the base of the stigma to the tip of the wing, with the first basal cell and the posterior cross-vein clouded; anterior cross-vein oblique. 6
   Flies not having the above characters. 2

2. Posterior angle of the anal cell drawn out into a sharp point (Mexico). OSTRACOCŒLIA Giglio-Tos.
   Posterior angle of the anal cell rounded. 3

3. Picture of the wings dark, varied with transparent spots and bars. 4
   Wings not so marked. 5

4. Scutellum large, flat; occiput but little swollen; veins of wings straight and markedly divergent. . . . . AMPHICNEPHES Loew.
   Scutellum smaller, not flattened; occiput much smaller; epistoma strongly projecting; third and fourth longitudinal veins nearly parallel, sinuous (Mexico and South America). PLATYSTOMA Meigen.

5. The picture of the wings consists of four blackish cross-bands, of which the third is nearly perpendicular, and the fourth lies along the costa at the apex of the wing; scutellum with four bristles. RIVELLIA Desvoidy.
   Wings without bands; scutellum with two bristles; ant-like flies. MYRMECOMYIA Desvoidy.

6. Posterior cross-vein prolonged beyond the fourth vein (Cuba). HIMEROESSA Loew.
   Posterior cross-vein not prolonged. 7

7. Fifth longitudinal vein bristly (Mexico). BRICINIELLA Giglio-Tos.
   Fifth longitudinal vein not bristly.* . STENOPTERINA Macquart.

CEPHALIINÆ.

Oral opening very large; clypeus and proboscis greatly developed; propleural bristle absent; sternopleural bristle present; sixth segment of the abdomen in the female distinctly developed; ovipositor flattened; first longitudinal vein bristly.

1. Slender, Sepsis-like flies, resembling Myrmecomyia, with wings almost hyaline, except for a small infuscation at the stigma and at the tip. CEPHALIA Meigen.
   Wings with a conspicuous picture. 2

* I can not see wherein *Bricinnia* Walker, to which Giglio-Tos refers a Mexican species, differs from *Stenopterina*.

2. Wings dark, with three oblique, more or less arcuated, hyaline cross-bands; first basal cell expanded before its end. TRITOXA Loew.
Wings not with such markings. 3

3. Wings broad, with a marked excision on the costa near the end of the auxiliary vein; second vein sinuous. CAMPTONEURA Macquart.
Flies not having such wings. 4

4. Posterior angle of the anal cell retracted. . . . IDANA Loew.
Posterior angle of the anal cell drawn out into a long lobe.
DIACRITA Gerstæcker.

ORTALINÆ.

The Ortalinæ differ from the Platystominæ and Cephalinæ in the small oral opening, the less developed clypeus, more slender proboscis and smaller palpi. The mesonotum is sometimes bristly in the middle anteriorly, the propleural and mesopleural bristles both present. Female abdomen with six segments.

1. Face sharply carinate. 2
Face not sharply carinate. 3

2. Third antennal joint circular; hairy species. TETROPISMENUS Loew.
Third antennal joint ending in a sharp point; pollinose flies.
TEPHRONOTA Loew.

3. Mesonotum bristly in the middle in front; third antennal joint excised above and with a pointed tip. . . , CEROXYS Macquart.
Mesonotum not bristly in the middle in front. 4

4. Third antennal joint distinctly excised above, pointed at the tip; fourth longitudinal vein with a marked anterior curvature on its distal part. . . . . ANACAMPTA Loew.
Third antennal joint not excised above; fourth vein not so curved; body nearly destitute of bristles or hairs. . TETANOPS Fallen.

PTEROCALLINÆ.

Trypeta-like; coloring nonmetallic; head rather broad, but low, with rather protuberant eyes; face short, perpendicular, excavated in the middle; clypeus but little developed; third antennal joint round or short oval; mesonotum bristly upon the posterior part only; third longitudinal vein hairy; tip of the first longitudinal vein and auxiliary vein remote from each other; posterior angle of the anal cell usually drawn out into a long lobe.

1. Posterior angle of anal cell drawn out into a long lobe; posterior cross-vein very oblique. 2
Posterior angle of anal cell not greatly produced. 3

2. Wings very narrow in proportion to their length, of equal width, broadly rounded at base and tip. . . . PTEROCALLA Rondani.
   Wings with an unusually convex posterior margin. CALLOPISTRIA Loew.

3. Anterior and posterior cross-veins very oblique, not approximated (Mexico). . . . . MYENNIS Desvoidy.
   Posterior cross-vein rectangular or nearly so. 4

4. Second longitudinal vein straight or nearly so; anterior cross-vein not oblique. 5
   Second longitudinal vein markedly sinuous; cross-veins approximated and the anterior one very oblique.* PARAGORGOPIS Giglio-Tos.

5. Cheeks rather broad; posterior angle of anal cell acute. STICTOCEPHALA Loew.
   Cheeks and face extremely short; eyes transversely oval; posterior angle of anal cell rectangular (New Mexico). PSAIROPTERA Loew.

ULIDIINÆ.

Head large, hemispherical; proboscis stout, with broad labella; front broad; antennæ short; mesonotum bristly in the middle behind only; first and third longitudinal veins of the wings bare, the third and fourth convergent distally; posterior angle of the anal cell acute, sometimes drawn out into a long lobe.

1. Head conspicuously large; front unusually broad and the antennæ very widely separated. 2
   Head not conspicuously large, the antennæ more approximated at their root. 3

2. Third antennal joint round; front punctulate. . . EDOPA Loew.
   Third antennal joint elongate; upper part of front rugose. EURYCEPHALA Rœder.

3. Posterior angle of anal cell acute, but scarcely prolonged lobe-like. 8
   Posterior angle of anal cell distinctly drawn out into a lobe. . 4

4. Front punctate or scrobiculate. 5
   Front smooth, ... 7

5. Scutellum flat, with sharp edges; fourth longitudinal vein strongly curved forward at its end; front coarsely rugose. NOTOGRAMMA Loew.
   Scutellum convex, rounded on its edges. 6

6. Stigma not unusually elongate. . . . . ULIDIA Meigen.
   Stigma elongate, about as long as the costal cell. ACROSTICTA Loew.

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* This genus is located here as definitely as the characters given will permit.

7. Face distinctly projecting below; third antennal joint rounded at the end. . . . . EUXESTA Loew.
Face retreating; third antennal joint with a sharp anterior angle. CHÆTOPSIS Loew.

8. Body extremely slender. 9
Body not slender; face carinate. . . . . SEOPTERA Kirby.

9. Front only slightly projecting in profile; face oblique. STENOMYIA Loew.
Front very much projecting, so that the head is conical and the face nearly horizontal. . . . . EUMETOPIA Macquart.

RICHARDIINÆ.

Mesonotum with bristles in the middle posteriorly only; femora often armed and incrassate; first longitudinal vein bare; posterior angle of the anal cell obtuse; costal vein usually broken just before the termination of the auxiliary vein; auxiliary and first longitudinal veins closely approximated, their tips near together.

1. Femora all armed with spines. 4
Femora unarmed. 2

2. Head shaped like a long, somewhat flattened cone. CONICEPS Loew.
Head not so shaped. 3

3. Wings but little developed; anal cell wanting. STENERETMA Loew.
Anal cell present. . . . . EPIPLATEA Loew.

4. Scutellum with two bristles; third and fourth longitudinal veins nearly parallel. 5
Scutellum with four bristles; ocelli remote from the vertex; last section of the fourth vein convergent toward the third (West Indies and South America). . . . . COELOMETOPIA Macquart.

5. Ocelli more approximated to the vertex; front not narrowed anteriorly (West Indies). . . . . NEOIDIOTYPA Osten Sacken.
Ocelli about half way between the vertex and the antennæ; front somewhat narrowed anteriorly (West Indies). . . STENOMACRA.

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44. TRYPETIDÆ.

Head hemispherical; face nearly perpendicular in profile or somewhat retreating, without distinct vibrissæ. Front broad, bristly on the sides, the lower fronto-orbital bristles situated close to the border of the eyes. Antennæ decumbent,

short, rarely elongated. Abdomen composed of four or five segments; genitalia of the males but little exposed; the ovipositor jointed, more or less projecting. Wings rather large; auxiliary vein present, ending steeply and obscurely in or near the border; posterior basal cell and the anal cell distinct, the latter often drawn out into an acute, often prolonged, point. Wings usually with dark markings. Legs moderately long; tibiæ without preapical bristle. Proboscis moderately long, usually with broad labella, sometimes long, and the narrow labella folding backwards.

This family comprises a large number of rather small flies usually with prettily marked wings. The larvæ are not elongate, conical and round; the posterior stigmata lie free in two separated small, chitinous platelets, forming three radiating depressions; antennæ short, two-jointed; mouth hooklets separated, thick and strong; anal end somewhat impressed, often in the middle with six, small, fleshy points. Puparia elliptical, the anterior stigmata projecting somewhat button-like. The larvæ of *Ceratitis* live in the flesh of oranges and lemons, those of *Aciura* have been found at the base of the flower stems of *Phlomis*, those of *Acida* mining in the leaves of *Rumex*, those of *Spilographa* mining in the leaves of *Senecio*, or *Arctium* or bred from the berries of *Solanum carolinensis*, in the fruit of *Prunus* and *Lonicera*, etc.; those of *Ensina*, in the blossoms of *Senchus;* those of *Tephritis* in the blossoms and galls of the stems or roots of various compositæ; those of *Carphotricha* in the galls and roots of *Achillea*, the flowers of *Hieracium*, etc. those of *Trypeta* in the heads of *Cirsium*, *Centaurea*, etc., and in stems of plants.

TABLE OF GENERA.

1. Ovipositor of female remarkably elongated and curved; second longitudinal vein usually with an anterior branch. TOXOTRYPANA Gerst.
   Ovipositor not remarkably elongated and curved. 2
2. Front on each side with a bristle having a terminal, leaf-like appendage. CERATITES Macleay.
   Front without such bristles. 3

3. Wings with colored markings not reticulate. 4
Wings hyaline or with the markings reticulate or spotted. . . 18

4. Scutellum with six bristles. . . . . Hexachæta Loew.
Scutellum not with six bristles. 5

5. Fourth longitudinal vein conspicuously curved forward at its tip. Acrotoxa Loew.
Fourth longitudinal vein not conspicuously curved forward at its tip. 6

6. Distal portion of the wing with two hyaline indentations, separated by a curved or arched brown projection from the brown oblique cross-band or spot before it, the anterior indentation more slender, the posterior one (in the second posterior cell, crossing or not the fourth vein) more triangular in shape.* 7
Wings not so marked. - 10

7. Body elongate; abdomen narrower than the thorax. Straussia Desvoidy.
Body short; abdomen as broad as the thorax. 8

8. Horizontal diameter of the eyes remarkably short. Stenopa Loew.
Horizontal diameter of the eyes not shorter than usual. . . 9

9. Antepenultimate section of the fourth vein straight. Acidia Loew.
Antepenultimate section of the fourth vein curved. Epochroa Loew.

10. Coloring of the body generally light, never black. . . . 11
Coloring of the body black. . - 15

11. Wings near the middle with two cross-bands, converging toward the posterior margin. 12
Wings not with such cross-bands. . . . - . . 13

12. The third longitudinal vein is gently curved backward toward the tip; head not swollen. . . , . . . Spilographa Loew.
Third longitudinal vein straight to the tip; head distinctly swollen. Œdicarena Loew.

13. Wings with four very oblique cross-bands; cross-veins very oblique. 14
Cross-bands nearly transverse, or dissolved into spots; cross-veins but little oblique. . . . . Trypeta Meigen.

14. Scutellum tumid, bituberculate. . . . . Peronyma Loew.
Scutellum of the usual structure, not swollen, though convex. Plagiotoma Loew.

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* In some varieties of *Straussia longipennis*, the distal hyaline indentations are obsolete.

15. Cross-veins conspicuously approximated. 16
Cross-veins not approximated. 17

16. Wings with hyaline indentations and a subapical, arcuate, hyaline cross-band; scutellum black. . . Polymorphomyia Snow.
Wings with three brown bands or projections, connected anteriorly, the distal one following the costa, the middle one beyond the middle of the wing, the proximal one toward the base. Œdaspis Loew.

17. Scutellum with four bristles, yellow; wings with black cross-bands. Rhagoletis Loew.
Scutellum with two bristles, black; wings with hyaline indentations along the margin. . . . . Aciura Desvoidy.

18. Fifth vein strongly bristly; scutellum with six bristles. Blepharoneura Loew.
Fifth vein not bristly; scutellum with four or two bristles. . 19

19. Wings banded on the apex. . . . . Acrotænia Loew.
Wings not banded on the apex. 20

20. Face spotted. 21
Face not spotted. 22

21. Wings very much dilated; pattern of picture not radiating. Eutreta Loew.
Wings not dilated; with radiating markings along the margin. Carphotricha Loew.

22. Front very broad. 23
Front not very broad. 25

23. Third antennal joint elongate, with a sharp anterior angle; ovipositor flattened. . . . . Acidogona Loew.
Third antennal joint short. 24

24. Wings with numerous small spots and larger ones along the distal margin; ovipositor conical. . . . . Eurosta Loew.
Wings with large, irregular, brown spots and hyaline spaces. Xenochæta Snow.

25. Wings without markings, or, on the apical half only with a reticulation dissolved into cross-bands. . . Neoaspilota Osten Sacken.
Flies not having the above characters. 26

26. Wings of an evenly broad shape, and with an unusually blunt apex. Icterica Loew.
Wings of the usual shape, or dilated. 27

27. Labella very much prolonged. . . . . Ensina Desvoidy.
Labella not or but little elongated. 28

28. Wing-markings radiating. 29
Wing-markings not radiating. . . . . Tephritis Latreille.

29. The whole or nearly the whole surface of the wing with unicolorous reticulation. . . . . Euaresta Loew.
A star-shaped black picture at the apex of the wing, the remaining surface immaculate, or with a very few spots, or at the most with an obsolete reticulation. . . . . Urellia Desvoidy.

45. SAPROMYZIDÆ.

Small species, seldom more than 7 millim. in length. Head as broad or a little broader than the thorax; front with one or two bristles on each side anteriorly to those of the vertex. Antennæ usually short and porrect, sometimes the third joint elongated. Face without vibrissæ on the oral margin. Abdomen short-ovate. Legs never elongate. Auxiliary vein of the wings present; cross-veins never approximated; basal cells small, but complete.

I include in this family the Sapromyzidæ and Lonchæidæ of Loew, though the characters are perhaps sufficient to justify their separation. The larvæ of Sapromyza live in decaying vegetable matter; they are slender, with two distinct mouth hooklets, the entire body, except the anterior segments, roughened by very small bristles. The segments are distinctly constricted, the penultimate segment with four conical processes in a transverse row, the terminal segment with two three jointed processes, between which is the cylindrical, stigmatic tube. In *Lonchæa* there are no conical processes on the penultimate segment, and the stigmatic tubes or processes are small and wart-like.

TABLE OF GENERA.

1. Tibiæ without preapical bristle; front with a single fronto-orbital bristle; ovipositor flattened and horny (*Lonchæinæ*). . . . 2
Tibiæ with a distinct preapical bristle; two fronto-orbital bristles; ovipositor not horny, ending tube-like (*Sapromyzinæ*).* . . 3

* *Chætocælia* Giglio-Tos (Mexico) has three fronto-orbital bristles, the anal cell rudimentary; arista pubescent, the face short, flat and vertical.

2. Metallic black species; front narrow. . . . Lonchæa Fallen.
   Yellow or yellowish species; front broad. . . Palloptera Fallen.

3. Arista with a short, dense plumosity; face with a strong gibbosity in the middle. . . . . Pachycerina Macquart.
   Arista slender, bare, pubescent or plumose, not having an appearance of solidity. 4

4. Face very broad, in profile strongly convex below. Physogenia Macquart.
   Face receding, flattened or gently arched. 5

5. First posterior cell much narrowed in the margin (Central and South America). . . . . Griphoneura Schiner.
   First posterior cell not or but slightly narrowed in the margin. . 6

6. Shining black species; third joint of antennæ more or less elongate. Lauxania Fallen.
   More or less yellow species; third joint of antennæ not more than three times as long as wide. . . . . Sapromyza Fallen.

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46. RHOPALOMERIDÆ.

Front broad, excavated, with or without short bristles. Antennæ short, third joint rounded or oval, the arista bare or plumose. Face broad, carinate, tuberculate or the oral margin prominent; cheeks broad; clypeus projecting; vibrissæ wanting; proboscis short; palpi slender or dilated. Thorax elongate, arched, mesonotum nearly bare; scutellum often prominent and grooved. Abdomen shorter than the wings, flattened; ovipositor projecting, telescopic; hypopygium largely concealed. Femora thickened, the hind tibiæ often dilated. Auxiliary vein present or absent; basal cells well developed.

This group comprises a small number of flies from six to twelve millimeters in length, of peculiar aspect, having a general resemblance to some of the Ephydridæ or Ortalidæ. I know nothing of their habits, whether in the adult or immature stages, though I suspect that they are denizens of wet or

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No mention is made of tibial bristles, and the author is in some doubt whether or not it should be located with the *Trypetidæ*.

damp places. The known species are confined to Central and South America.

The group is evidently sharply divided into two minor groups, by the presence or absence of the auxiliary vein and the length of the first longitudinal vein.

TABLE OF GENERA.

1. Auxiliary vein wanting, the first longitudinal vein short; first posterior cell of the wings not narrowed; palpi slender (*Rhinotorinæ*, Central and South America). . . . . Rhinotora Schiner.
   Auxiliary vein well-developed, the first longitudinal vein longer; first posterior cell much narrowed in the margin; palpi dilated (*Rhopalomerinæ*). 2

2. Scutellum oval; arista plumose. 3
   Scutellum pyramidal, directed obliquely upward; arista plumose or bare (Central and South America). . Rhopalomera Wiedemann.

3. Front with bristles; face carinate; hind tibiæ dilated and with tubercles (Central and South America). . . . Willistoniella Mik.
   Front without bristles; face tuberculate; hind tibiæ slender (S. Amer.) Apophorhynchus Williston.

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47. HELOMYZIDÆ.

Face usually nearly perpendicular, with vibrissæ; front bristly on the posterior half only; antennæ short. Abdomen rather broad and long, more or less flattened, composed of six segments; male genitalia somewhat prominent; costa of the wings bristly; first longitudinal vein bare. Wings comparatively large; all the basal cells distinct. Tibiæ with spurs and a preapical bristle.

The larvæ of *Leria* have been bred from bat and rabbit dung; those of *Helomyza* from truffles, decaying wood, etc. They are cylindrical, obtuse behind, more pointed in front; the antennæ situated upon long, conical processes; mouth hooklets large and pointed; the seven abdominal segments on each side in front widened, below with bristly pseudopods. Many of the species of this family live in caves or burrows.

TABLE OF GENERA.

1. A humeral bristle present. . . . . Helomyza Fallen.
   No humeral bristle present. 2

2. No bristle above the base of the front coxæ. . . Allophyla Loew.
   A bristle above the front coxæ present. 3

3. Spurs of the middle tibiæ curved; hair of the body comparatively long and soft. . . . . Scoliocentra Loew.
   Spurs of the middle tibiæ straight; hair neither long nor soft. . 4

4. Anterior oral border obliterated. . . . Anorostoma Loew.
   Anterior oral border distinctly developed. 5

5. Eyes remarkably small. . . . . Œcothea Loew.
   Eyes not remarkably small. 6

6. Four bristles in the median dorsal thoracic rows. 7
   But three bristles in the median dorsal rows. . Tephrochlamys Loew.

7. Costal border of the wing very noticeably bristly; front broad. Leria R. Desvoidy.
   Costal border with extremely small bristles; front narrow. Heteromyza Fallen.

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48. HETERONEURIDÆ.

Head large, hemispherical. Face short, nearly perpendicular. Vibrissal bristles present. Front broad, bristly to the root of the antennæ. Antennæ porrect, short. Abdomen elongate, narrow, somewhat compressed; genitalia but little prominent. Wings broad and rather long; all three basal cells distinct; cross-veins much approximated. Legs long; tibiæ with or without a preapical bristle.

Larvæ of this family have been found in decaying wood, under bark of trees, etc. They are slender, cylindrical, slightly thickened posteriorly, white in color. The mouth hooklets are very small, the body segments not distinctly separated; abdominal segments with a transverse swelling for locomotion. The larvæ have the power of leaping, as do those of *Piophila*. The act is performed by fixing the mouth hooklets in the two chitinous, straight or curved hooklets on the upper

side of the last segment and then suddenly releasing them. The puparia are yellowish, ellipsoidal and with two horns on the last segment as in the larvæ.

TABLE OF GENERA.

1. A long preapical bristle on the hind tibiæ. HETERONEURA Fallen.
   No such preapical bristle on the hind tibiæ. . CLUSIA Halliday.

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49. SCIOMYZIDÆ.

Head rounded,* short, as broad or broader than the thorax; face more or less retreating; mouth without vibrissæ at its border, sharp. Abdomen composed of six segments, rather long and narrow. Wings longer than the abdomen; auxiliary vein present, distinctly separated from the first longitudinal vein; posterior basal cell and the anal cell complete. Legs rather long; preapical tibial bristle present.

The members of this family are usually found in meadows, along the banks of small streams, etc., wherever it is moist. They are, for the most part, brown or brownish yellow in color, oftentimes with pictured wings. They are slow in their habits. The larvæ are slender, cylindrical, thin anteriorly, the last segment with six or eight conical, fleshy tubercles. They are aquatic.

TABLE OF GENERA.

1. Antennæ short. 2
   Antennæ elongate. 4
2. Face excavated, the oral margin protuberant. 3
   Face retreating in profile, but little or not at all excavated; oral margin not at all prominent. . . . . SCIOMYZA Fallen.

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* The genus *Trigonometopus* Macquart, has been assigned to the *Pyrgotinæ* by Schiner, to the *Heteroneurinæ* by Loew. It will be sought for in this family by the student, and I believe that it rightfully belongs here. It will be recognized by its conically projecting head, and strongly receding face. The cheeks have a row of well developed bristles situated on a ridge descending from the front near the eye and extending back to the occiput; the third antennal joint is rounded or a little elongated.

3. Cheeks broader than the long diameter of the eyes; oral border moderately protuberant; costa somewhat spinose. . ACTORA Meigen.
Cheeks not broader than the long diameter of the eyes; oral margin very prominent; costa bare. . . . . DRYOMYZA Fallen.

4. Hind femora long: second antennal joint much elongated, longer than the third. 5
Hind femora only moderately elongated and but little thickened; second antennal joint as long or a little shorter than the third.
TETANOCERA Latreille.

5. Hind femora thickened; face not produced downward.
SEPEDON Latreille.
Hind femora not thickened; face much produced downward (Central ? and South America). . . . . THECOMYIA Perty.

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50. PHYCODROMIDÆ.

Pleuræ, scutellum and abdomen flat. Front bristly; cheeks and face bristly, the vibrissæ indistinctly differentiated. Legs stout, all the tibiæ spurred and with a preapical bristle on the outer side; metatarsi not abbreviated; terminal joint of all the tarsi incrassate and without claws. Neuration of wings complete; auxiliary vein distinct in its entire course; costa without bristles; basal cells not small.

But a single genus of this family is known to occur in North America, *Cœlopa* Meigen. Members of it are found in great abundance among sea-weed and other algæ thrown up by the waves along the sea-shore.

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51. SCATOMYZIDÆ.

Tegulæ small, the upper one concealing the lower one. Head rounded, eyes round, bare, broadly separated by the front in both sexes. Wings large; auxiliary vein always present, the costa never with bristles at its termination, three basal cells always present; first posterior cell never narrowed or closed. Abdomen with more than four segments.

The flies of this group are easily confounded with the

Anthomyidæ, but the characters above given will in most cases render the differentiation a matter of little difficulty. Still, it is evident that the two families run closely together, and the student will sometimes be in doubt. The family as here accepted is that of Becker, who has recently given an exhaustive study to the European forms. He has established a considerable number of new genera, many of which will undoubtedly be found to occur in North America. For that reason, I have thought it best to give a translation of his tables of the genera, with but slight modifications or abbreviations.

The genera so far recognized in North America are *Scatophaga*, *Hydromyza*, *Norellia*, *Cordylura* and *Cleigastra* in their wider sense. *Fucellia*, Becker refers to the Anthomyidæ. The species of *Scatophaga* are for the most part yellowish brown in color, the males often with wooly hair. The flies are frequently found about excrement, but they also feed upon other insects, which they capture. Species of *Cordylura* and *Cleigastra* are mostly slender and cylindrical, and of moderately large size. They are usually found in meadows or other moist places. The larvæ are cylindrical, thin-skinned, the mouth hooklets short and thick, the anterior stigmata large, projecting, reniform in shape, the posterior stigmata situated on rounded eminences. The larvæ of *Norellia spinimana* have been found in the stems of *Rumex;* those of *Cordylura convallariæ* in the stems of *Convall ria ;* those of species of *Cleigastra* in stems of *Rumex*, from swine-dung and from the larvæ of *Noctua ;* those of *Hydromyza* from *Nuphar.*

TABLE OF GENERA.

1. Prothoracic and stigmatic bristles wanting; a sternopleural bristle present, sometimes wanting. Thorax with five dorsocentral bristles, or if fewer, the palpi broad. Scutellum with at least four bristles. Wings usually long. 2

Prothoracic and stigmatic bristles usually present; when wanting the thorax nearly bristleless. One to three sternopleural bristles present. Thorax with one to five dorsocentral bristles; the scutellum with two to four. Wings usually short. 3

2. Head broad; palpi spoon-shaped or leaf-like. . HYDROMYZINÆ.
Head round not especially broad; palpi linear or rarely ribbon-like (*Scalophagmæ*). . . . . SCATOPHAGA.

3. Front femora on the inner side with a double row of bristles. NORELLINÆ.
Front femora and tibiæ at the most with a single row of bristles. 4

4. Face short; palpi small, linear, never with long hairs or bristles. Antennæ short; the arista bare or pubescent. . CLEIGASTRINÆ.
Face long; palpi linear, sometimes flattened, with or without long, terminal bristles. Antennæ variable; arista bare or plumose. Species usually bristly. . . . . CORDYLURINÆ.

CORDYLURINÆ.

1. Palpi small, linear. 2
Palpi long, widened leaf-like. 14

2. Palpi with a long terminal bristle; a single sterno-pleural bristle present. 3
Palpi without long terminal bristle; one to three sterno-pleural bristles present. 6

3. Third antennal joint short; second more or less projecting over the third. 4
Third antennal joint long, as long as the face, the second joint not projecting; arista long, plumose; shining black species. PHROSIA R. Desvoidy.

4. Arista plumose in the middle or pubescent; costa hairy or ciliate; third longitudinal vein straight or gently curved. 5
Arista bare; costa but slightly hairy; third longitudinal vein curved S-shaped. . . . . SCOLIAPHLEPS Becker.

5. Arista thickened at the base, plumose to its middle; femora and tibiæ with strong bristles; thorax with five dorsocentral bristles; face narrowed at the antennæ; usually shining black species. CORDYLURA Fallen.
Arista scarcely thickened at the base, plumose; femora and tibiæ slender and long but little bristly; one to three dorsocentral bristles present; face and front of equal width; yellow and black species. PARALLELOMMA Becker.

6. One sternopleural bristle. 7
Two sternopleural bristles. 9
Three sternopleural bristles. 10

7. Eyes nearly twice as high as long; front convex; antennæ short, situated low down; pale yellow species. . LEPTOPA Zetterstedt.
Eyes but little higher than long; antennæ as long as the face; oral border with a single, anteriorly directed bristle. . . . 8

8. Third antennal joint broad; front convex; arista distinctly plumose; five dorsocentral bristles present; moderate sized, shining yellow species. . . . . MEGOPHTHALMA Becker.
Third antennal joint long and slender, arista naked; four dorsocentral bristles; shining black species. . . MICROPSELAPHA Becker.

9. Antennæ as long as the face, third joint rounded, strongly pubescent; four dorsocentral, two scutellar bristles; hind tibiæ with two pairs of exterior bristles; shining black. . HEXAMITOCERA Becker.
Antennæ long as the face, third joint with a sharp upper corner; arista geniculate in both sexes; five dorsocentral, four scutellar bristles; hind tibiæ with three pairs of bristles; small, grayish dusted species. GONATHERUS Rondani.

10. Male arista distinctly geniculate. 11
Arista geniculate in neither sex. 12

11. Third antennal joint long and broad, with an acute upper angle; arista short, bare; four scutellar bristles; dark gray-dusted, bristly species. GONARCTICUS Becker.
Third antennal joint long and narrow with rounded upper angle; arista finely plumose; two scutellar bristles; shining black, bristly species. CNEMOPOGON Rondani.

12. Arista distinctly hairy; four scutellar bristles; hind tibiæ with three pairs of exterior bristles. . . . . ORTHACHÆTA Becker.
Arista bare; antennæ long, third joint usually angulated above; two scutellar, two pairs of tibial bristles. . AMAUROSOMA Becker.

13. Eyes circular; antennæ long, rounded at tip; palpi of usual length somewhat broadened distally; abdomen very short. SPATHIPHYLLUS Becker.
Eyes somewhat elongate; antennæ long, angulated at tip; palpi much dilated its whole length; abdomen not remarkably short. PSELAPHOPHILA Becker.

HYDROMYZINÆ.

1. Eyes and head round; thorax with five dorsocentral bristles. . 2
Eyes and head oval, higher than long; one dorsocentral bristle; antennæ short; abdomen flat; third and fourth longitudinal veins convergent; large, bare grayish dusted species. HYDROMYZA Fallen.

2. One sternopleural bristle; wings without spots. 3
   No sternopleural bristle; wings with round, brown spots.
   ERNONEURA Becker.

3. Front tibiæ with a terminal, short rectangularly spine (in addition to the ordinary bristles). . . . . ACANTHECNEMA Becker.
   Front tibiæ without such spine. 4

4. Hypopygium with long tufts of hairs. 5
   Hypopygium without long tufts of hairs. 8

5. Third antennal joint somewhat elongate, angulated at the tip; oral border with numerous, closely placed bristles. . . . 6
   Third antennal joint short, rounded at tip; oral border with two remote bristles. . . . . BOSTRICHOPYGA Becker.

6. Wings with two supernumerary cross-veins. POGONOTA Zetterstedt.
   Wings not with supernumerary cross-veins. . OKENIA Zetterstedt.

7. First posterior cell closed. . . . . LASIESCELUS Becker.
   First posterior cell open or but little narrowed. 8

8. Much elongated species. 9
   Short or but little elongated species. 10

9. Middle and hind femora of the male strongly thickened.
   STÆGERIA Rondani.
   All the femora slender. . . . . COSMETOPUS Becker.

10. Third antennal joint rounded distally. . MICROPRESEPA Becker.
    Third antennal joint angulated distally. 11

11. Mesonotum and legs thickly hairy. . . SPATHIOPHORA Rondani.
    Mesonotum and legs thinly and not long hairy. 12

12. Antennæ small, abgulated at tip; arista thickened at base; small, short, gray species. . . . . TRICOPALPUS Rondani.
    Antennæ large, broad, rounded at tip; arista thickened to near the tip.
    ACEROCNEMA Becker.

CLEIGASTRINÆ.

1. Five dorsocentral, two scutellar, one posthumeral bristles; black species. . . . . CLEIGASTRA Macquart.
   Two or three dorsocentral, front scutellar and two post-humeral bristles; honey-yellow species. . . . GIMNOMERA Rondani.

NORELLINÆ.

1. Front femora with two rows of strong bristles, the outer ones long and strong, the inner ones short. . . . NORELLIA R. Desvoidy.
   Front femora with four spines, bristles on the outer side only.
   ACHANTHOLENA Rondani.

52. ANTHOMYIDÆ.

Small to moderately large flies, often resembling the common house-fly, usually non-metallic in color. Antennal arista plumose, pubescent or bare; eyes hairy or bare; males often holoptic, sometimes broadly dichoptic, the females always dichoptic; abdomen composed of four or five segments; the male genitalia often with subanal appendages; first posterior cell of wings broadly open; body often without bristles; tegulæ usually of considerable size.

The above definition will, in most cases, distinguish the members of this large family of inconspicuously colored flies. Its limits, however, are not sharp; with the true muscids it is connected by *Morellia* and allied forms, with the Scatophagidæ by *Fucellia*, etc. When one has become tolerably well acquainted with the allied families, he will seldom be much in doubt as to the proper location of his specimens here. The contiguity of the male eyes, together with the open first posterior cell, is always decisive. Not a few of the species are common about houses, out-buildings, etc., and some of them are among the worst enemies to garden vegetables that the agriculturist has to contend against.

In the larval stage, the great majority of the species are vegetable feeders, either in living or decaying material. The larvæ of species of *Spilogaster*, *Hydrotæa*, *Hylemyia* and *Cænosia* have been found in dung or manure; those of *Hydrotæa*, *Oyhyra*, *Anthomyia*, *Homalomyia*, etc., in decaying vegetable material; those of *Hylemyia*, *Anthomyia*, *Homalomyia*, etc., in the nests of various hymenoptera; those of *Mydæa* from *Spermophila* and *Mimus*. Larvæ of various species or *Phorbia* are very destructive to growing radishes, onions, cabbage, etc., feeding upon the roots. The larvæ are either slender and cylindrical, or flat and oval, with four rows of thread-like processes on the segments. Both types are amphipneustic, and are always provided with two chitinous

mouth-hooklets. The puparium is oval in the smooth cylindrical forms, or flattened in the others.

The flies have received but little attention in this country and not a great deal elsewhere. The following table has been mostly compiled from Meade, Schnabl, Rondani and Schiner, with the aid of the table given by Townsend.

Tegula and antitegula are the terms proposed by Osten Sacken to indicate respectively the lower and upper scales.

TABLE OF GENERA.

1. Front in both sexes wide, including at least one-third of the width of the head of the male. 16
   Front narrow in the male, never more than one-fifth of the width of the head, often holoptic or sub-holoptic. 2

2. Tegula larger than the antitegula. 3
   Tegula and antitegula of nearly equal size, neither large. . . 14

3. Front femora of the males with tubercles or emarginations below, or otherwise peculiarly constructed; front tibiæ often with emarginations; hind femora often arcuate; middle and hind tibiæ sometimes with tufts of hairs; arista always somewhat pubescent, sometimes distinctly plumose; eyes bare (if hairy *Odontontha* Rond.); abdomen without macrochætæ; species black or blue-black in color, sometimes pollinose. . . . . HYDROTÆA Desvoidy.
   Front femora simple in the male. 4

4. Proboscis projecting, horny, the labella slender and pointed, turned backward, hook-like; antennæ short, arista pubescent, eyes bare; moderate-sized, blackish gray species. . . DRYMEIA Meigen.
   Proboscis not horny and hook-like. 5

5. Eyes hairy, more so in the male; arista plumose; abdomen not spotted. HYETODESIA Rondani.
   Eyes bare. 6

6. Abdomen distinctly spotted 7
   Abdomen not spotted. 9

7. Arista plumose; hypopygium small; blackish gray, yellowish gray or reddish yellow species. . . . SPILOGASTER Macquart.
   Arista bare. 8

8. First posterior cell not coarctate. . . . LIMNOPHORA Desvoidy.
   First posterior cell coarctate in the margin. LEUCOMELINA Macquart.

9. Arista plumose. 10
Arista bare. 11

10. Sixth vein of the wings prolonged to the posterior margin of the wing. . . . . Hydrophoria Desvoidy.
Sixth vein not prolonged. . . . . Mydæa Desvoidy.

11. Sixth vein of the wings very short, with the axillary vein curved towards it at the tip. 12
Sixth vein elongated. 13

12. Abdomen depressed, nearly bare; head hemispherical, composed almost wholly of the eyes; antennæ shorter than the face, the third joint often elongated; legs moderately long, the middle pair in the male often with peculiar structures; black or gray species, some of them common in dwelling houses. . . Homalomyia Bouche.
Abdomen narrow, subcylindrical; males velvety black with spotted abdomen. . . . . Azelia Desvoidy.

13. Dark metallic black or blue-black species; hind tibiæ often arcuate; abdomen oval. . . . . Ophyra Desvoidy.
Species otherwise colored than shining black or metallic blue; hind tibiæ not arcuate (*Brachyophyra* Giglio-Tos). Anthomyia Meigen.

14. Arista plumose; moderate sized to small, elongate species, of gray or blackish color; eyes bare; abdomen usually with sub-anal appendages in the male. . . . . Hylemyia Desvoidy.
Arista bare or slightly pubescent. 15

15. Eyes hairy; black species with the abdomen sometimes reddish yellow. Lasiops Meigen.
Eyes bare (inclusive of *Pegomyia* and *Phorbia*). Chortophila Rondani.

16. Palpi dilated spoon-shaped. . . . . Lispa Latreille.
Palpi slender, not dilated. 17

17. Arista plumose. . . . . Caricea Desvoidy.
Arista pubescent or bare. 18

18. Tegula larger than the antitegula, both of moderate size. Cænosia Meigen.
Tegula and antitegula of equal size, both small.* Schœnomyza Haliday.

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* The genus *Fucellia* Desvoidy is relegated to the Anthomyidæ by Becker. The known American species (*L. fucorum*) lives along the seashore. It is rather thickly bristly and the hind femora in the male have a conspicuous tuft of short black bristles near their base.

53. ŒSTRIDÆ.

Flies of moderate to rather large size, thick-set, usually more or less pilose. Head large, the lower part more or less swollen. Antennæ short, three-jointed, decumbent, and more or less sunken in the facial groove or grooves; arista bare or plumose. Mouth opening small, the mouth-parts sometimes rudimentary, never large. Front broad in both sexes, in the male broader in front. Eyes comparatively small, bare. Ocelli present. Thorax robust, with a distinct transverse suture. Abdomen short, conical or but little elongated; genitalia of the male hidden, the ovipositor sometimes elongated. Legs moderately long, the hind pair sometimes elongated. Tegulæ usually large; sometimes small. Neuration of the wings Muscid-like, in most cases the first posterior cell narrowed or closed; anal cell small, usually indistinct; discal cell sometimes absent.

This family, though of small size comparatively, is of the greatest interest by reason of the habits of the larvæ, all of which that are known are parasitic upon mammals. The adult flies often have rudimentary mouth-parts, and devote the whole of their brief existence to the labors of procreation. Only about seventy species are known, and they are generally called bot-flies, though the name is frequently applied especially to the bot-fly of the horse. Parasitism occurs in three principal ways, in the stomach and digestive tubes, in tumors formed by the larvæ under the skin, and in the pharyngeal and nasal cavities. With but few exceptions each species is confined to a single species of mammal, and each genus or each group of allied species is parasitic in the same way upon similar animals. Seven species of *Gastrophilus* are found in the stomach and intestines of the horse and ass. Thirteen species of *Hypoderma* are known to live under the skin of the horse, the ox, the buffalo, the sheep, the goat, four species of antelope, and the musk deer. Two species of *Œstromyia* likewise infest the skin of *Lagomys* and *Hypodæus*. *Œdamagena*

tarandi is parasitic in great numbers in the skin of the reindeer in both Siberia and boreal America. Four or five species of *Œstrus* live in the nasal sinuses of sheep, antelope, and horse (*Rhinœstrus*). One species of *Cephalomyia* lives in the nasal cavities and throat of the camel and buffalo. Six or seven species of *Cephenomyia* have been found parasitic in the pharyngeal cavities of various Cervids, while various species of *Cutrebra* and *Rogenhofera* have been bred from the skin or scrotum of different rodents, and opossums. Two species of *Dermatobia*, from the skin of dogs, cattle, cats, deer, and probably apes and man.

TABLE OF GENERA.

IMAGINES.

1. Mouth-parts very small or rudimentary; arista bare. . . . 2
   Proboscis geniculate, inserted in a deep slit; female without extricate ovipositor; first posterior cell narrowed or closed; arista bare or plumose. 5

2. Face with a median groove. 3
   Face with a broad, gently arched shield-shaped surface; first posterior cell narrowed or closed; tegulæ large; female with elongated ovipositor; larvæ hypodermatic. 6

3. The fourth longitudinal vein runs straight to the margin of the wing; tegulæ small; female ovipositor elongate; larvæ in stomach and intestinal canal. . . . . Gastrophilus Leach.
   First posterior cell narrowed or closed; tegulæ large; ovipositor not elongate; larvæ in nasal and pharyngeal cavities. . . . 4

4. First posterior cell closed and petiolate; body nearly bare. Œstrus Linne.
   First posterior cell narrowly open; body pilose. Cephenomyia Latreille.

5. Palpi wanting. . . . . Hypoderma Latreille.
   Palpi present. . . . . Œdamagena Latreille.

6. Arista plumose on the upper side. 7
   Arista bare, short and stout; tegulæ large; wings without stump at angle of fourth vein (Mexico). . . . . Bogeria Austen.

7. Tarsi broad, flattened. . . . . Cuterebra Clark.
   Tarsi slender. . . . . Dermatobia Brauer.

LARVÆ.

1. Last abdominal segment free, broadly attached. 2
   Last abdominal segment (twelfth) retractile within the preceding, small and distinctly constricted. 7

2. Larvæ with two pairs of chitinized jaws, that is with two outer mouth-hooklets, and two inner, straight, triangular points (Horses). GASTROPHILUS.
   Larvæ with two or no mouth-hooklets. 3

3. Larvæ on the median segments with dorsal, spindle-shaped tubercles; one pair of mouth-hooklets present. 4
   Larvæ without such tubercles; one pair or no mouth-hooklets present. 5

4. Antennæ broadly separated; body oval, strongly convex above, flat below (Sheep). . . . . ŒSTRUS.
   Antennæ approximated or contiguous; body elongated, somewhat broader in front than behind (Deer). . . . CEPHENOMYIA.

5. No mouth-hooklets. 6
   Two small mouth-hooklets present (Rodents). . . ŒSTROMYIA.

6. Bristly covering alike above and below (Reindeer). . ŒDAMAGENA.
   Bristles stronger below than above (Ox, etc.) . . HYPODERMA.

7. Larvæ oval (Rodents, Marsupials). . . . . CUTEREBRA.
   Larvæ club-shaped, more slender posteriorly (Artiodactyls, Carnivora, Primates). . . . . DERMATOBIA.

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54. SARCOPHAGIDÆ.

Usually thick-set, moderately large to rather small flies. Front in both sexes broad, though usually somewhat narrower in the male. Arista of the antennæ plumose to the middle or a little beyond, the distal portion bare; this last character alone is the ultimate distinctive one of the group. Abdomen composed of four visible segments, with the macrochætæ usually confined to the distal portion, though sometimes occurring on the margin of the second and following segments and very rarely on the disk; male hypopygium often prominent. First posterior cell of the wings always much narrowed or closed.

This family of flesh-flies, as they are often called, though

comprising but comparatively few genera, has a greater number of species and individuals. For the most part the species are tolerably uniform in coloration, and at first sight seem scarcely distinguishable, having a gray striped thorax and marmorate abdomen. The more metallic colored species of *Cynomyia* and *Onesia* are exceptions. The flies are found everywhere, about decaying vegetation, especially fruit, excrement, decomposing carcasses, etc.

The larvæ are polyphagous in habit, feeding upon decaying animal or vegetable matter, or living parasitically in the flesh of different animals, in the nasal cavities of man and other animals, in ulcers, etc. The larvæ of *Cynomyia* live in great numbers in the decomposing carcasses of vertebrate animals. The larvæ of *Sarcophaga*, which are often extruded by the parent fly alive, have been found under the skin of turtles, in the stomach of frogs; and most of the cases of myiasis that have been reported, other than those due to the larvæ of *Compsomyia* and *Calliphora*, have been caused by the maggots of the species of this genus and those of *Sarcophila*. The larvæ of several species have been found in snails, in beetles, the pupæ of moths, etc.

The Sarcophagid larvæ are rounded, thinner anteriorly and amphipneustic. The antennæ are short, thick, cylindrical, divergent, wart-like tubercles, each with two ocellus-like chitinous rings at the tip. The mouth-hooklets are distinct, strongly curved, and separated from each other. The abdominal segments are distinctly differentiated by transverse swellings, and are each provided with a girdle of spines. The hind stigma-plate is situated in a deep cavity, which is formed by the last segment alone. The anal swelling is two-pointed. The puparium is oval.

TABLE OF GENERA.

1. First posterior cell closed or very much narrowed in the margin. 2
   First posterior cell open. 4

2. Abdomen with both discal and marginal macrochætæ on the second and following segments. . . . . PARAMINTHO Wulp.
   Abdominal segments with discal macrochætæ. 3
3. First longitudinal vein bristly. . . . JOHNSONIA Coquillett.
   First longitudinal vein not bristly, SARCOPHILODES Brauer and Berg.
4. Abdomen black or metallic, unicolorous and but slightly pruinose. 5
   Abdomen gray, cinerous or partly ochraceous, with black reflecting spots. 7
5. Hypopygium very prominent; legs more or less hairy. . . 6
   Hypopygium concealed; legs not hairy; abdomen metallic; curvature of fourth vein with an obtuse angle and without stump. ONESIA Desvoidy.
6. Abdomen usually black; tibiæ densely hairy. PHRISSOPODA Macquart.
   Abdomen metallic; tibiæ with short hair. CYNOMYIA Desvoidy.
7. All the tibiæ on the outer side with a comb-like row of long, stout bristles. . . . . THERIA Desvoidy.
   Tibiæ without bristles or with irregularly placed ones. . . . 8
8. Apical cross-vein more oblique than the posterior one. . . . 9
   Apical and posterior cross-veins in nearly the same line; two orbital bristles in the ♀, none in the ♂. . . SARCOPHAGA Meigen.
9. Two orbital bristles in each sex. . . . SARCOPHAGULA Wulp.
   Two orbital bristles in the ♀ (♂?) . . HELICOBIA Coquillett.

55. MUSCIDÆ.

Rather small to moderately large, never elongate, thinly hairy or bare flies. Antennal arista plumose to the tip; sometimes above only, and rarely bare, in which cases the absence of bristles on the abdomen, except at the tip, together with the distinctly narrowed first posterior cell, characters distinctive of the group, will distinguish the flies belonging here from its allies. Eyes of the male approximated or contiguous; front of female broad. Eyes bare or hairy. Abdomen composed of four visible segments. Genitalia not prominent.

Like the Sarcophagidæ, the species and individuals of this family are common everywhere. The common house-fly, the type of the group, has a cosmopolitan distribution wherever man exists. Other species, which are scarcely less common and widely distributed, are the common blue-bottle and blow-

flies, members of the genera *Lucilia* and *Calliphora*. As widely known are the stable-fly or cattle-fly, *Stomoxys*, and the horn-fly, *Hæmatobia*.

The larvæ of the house-fly live, for the most part, in dung or manure, but will thrive in almost any kind of filth; I have reared them from the decaying material in the bottoms of spittoons filled with tobacco. The female lays about one hundred and fifty eggs, which hatch in one or two days, according to the weather. The larvæ attain their full development in from five to seven days, and then, crawling into some secluded place, transform into pupæ, from which they emerge in about six days as mature insects, those of the autumn broods remaining over winter as puparia. In partially secluded spots the mature fly will sometimes survive the winter. The cluster-fly, *Pollenia rudis*, is yet more remarkable in this last respect. Often in early spring, or even during mild days of the winter they may be observed crawling about over the snow in numbers. They are stupid and slow and have received the name of cluster-flies from their habit of congregating in clusters about dwellings. They resemble a blow-fly somewhat, but will be distinguished by the presence of short, depressed, sparse light colored hairs on the thorax. The larvæ of species of *Calliphora*, especially of *C. vomitoria*, are better known, perhaps than those of any other insect. They are the common blow-fly maggots of fresh and decaying meats and vegetables. The cooking of corned beef or turnips or cabbages during warm weather is sure to attract numbers of these insects, which are quite noticeable for their loud humming, and headlong flight. In the arid regions of northern Wyoming, the writer has seen them in extraordinary numbers, many miles from the nearest human habitation. Either their eggs or the newly hatched larvæ are deposited upon meats, and only a day or two is sufficient to transform the mass into a creeping mass of disgusting maggots. The larvæ of species of

this genus sometimes have habits similar to those of *Compsomyia*. The blue-bottle and green-bottle flies have habits identical with those of *Calliphora*, but they are not so common. The screw-worm fly, an insect common over nearly all of North and South America, is a bright shining green or golden green in color, but will be distinguished from the blue-bottles by the presence of blackish stripes on the thorax. It deposits eggs, which hatch almost immediately, in decomposing matter, as do other members of the family, but it will also lay them in the ulcers of cattle, or wounds, or at the orifice of the human nose, especially when attracted thereto by a fetid breath. The larvæ in these cases quickly penetrate within the nasal and frontal sinuses, sometimes to the number of a hundred or more, quickly producing fever, extended ulceration and in frequent cases, death. These cases of Myiasis, as the affection is called, are not very frequent in North America, but have been not seldom recorded from South America. *Sarcophila Wohlfahrti*, a European species, has similar habits.

The group of Stomoxyinæ includes the common stable or cattle-fly, the horn-fly and the famous tsetze fly of Africa and Australia, all of which lay their eggs in fresh dung. The horn-fly is a recent introduction from Europe, and has now extended over nearly all of the United States. An allied species, *Hæmatobia alcis* Snow, lives among the moose of the northern woods. The tsetze fly is perhaps the most famous of the group. Its bite is so poisonous that the regions which it inhabits are rendered impassable for horses and dogs, though it is less troublesome to other animals.

The larvæ of *Muscina* have been found in decaying vegetables, dung, fungi and the larvæ of various lepidoptera. The larvæ of *Graphomyia* and *Mesembrina* have been found in cow and horse dung.

The following table is that of v. d. Wulp (Biol. Centr. Amer. Dipt. ii, 291) with the addition of those genera not yet known from Central America.

TABLE OF GENERA.

1. Proboscis long and slender, directed forward; arista plumose on the upper side only. 2
   Proboscis not elongate, the labella prominent and not adapted for piercing. 3

2. Palpi nearly as long as the proboscis. . . HÆMATOBIA Desvoidy.
   Palpi shorter than the proboscis. . . . STOMOXYS Geoffroy.

3. Arista plumose on both sides. 5
   Arista bare or plumose above only. 4

4. Arista bare. . . . . SYNTHESIOMYIA Brauer and Berg.
   Arista plumose above (*Idia viridis* Wied.?) HEMICHLORA v. d. Wulp.

5. Curvature of fourth vein angular. 6
   Curvature of fourth vein rounded or arcuate. 12

6. Eyes pilose. . . . . TYREOMMA v. d. Wulp.
   Eyes bare. 7

7. Middle tibiæ without bristles on the inner side (blackish species with the abdomen more or less yellow, but always without metallic coloration). . . . . MUSCA Linne.
   Middle tibiæ with one or more bristles on the inner side (often with metallic coloration on the abdomen or other parts of the body.) 8

8. Thoracic dorsum usually blackish. 9
   Thorax, scutellum and abdomen brightly metallic. . . . 11

9. Dorso-central bristles present. 10
   Dorso-central bristles absent; no bristles above the vibrissæ. CHLOROPROCTA v. d. Wulp.

10. Thorax and abdomen with depressed hairs among the bristles, especially noticeable near the root of the wings. POLLENIA Desvoidy.
    No such hairs present. . . . . CALLIPHORA Desvoidy.

11. Thoracic dorsum with rather distinct black and whitish stripes. COMPSOMYIA Rondani.
    Thorax unicolorous, metallic, at most with some whitish tomentum on the anterior portion. . . . . LUCILIA Desvoidy.

12. Wholly metallic species. . . . . PYRELLIA Desvoidy.
    Black, grey or rufous species, sometimes the abdomen, its base excepted, metallic. 13

13. Apical cross vein distinct, longer than the terminal portion of the fourth vein before its curvature; apical cell opened a little before tip of wing. 14
    Apical cross-vein less conspicuous; fourth vein curved upwards at its extremity only; apical cell wide open at tip of wing. . . 16

14. Antennæ at base slightly separated by a carina (body grey or partly rufous, with a well-defined black pattern). Graphomyia Desvoidy.
Antennæ not separated by a carina. 15

15. Middle tibiæ with a bristle on inner side; apical cell widely opened. Mesembrina Macquart.
Mesembrinella Giglio-Tos.
Middle tibiæ without bristles on inner-side; apical cell somewhat narrowly opened (*Cyrtoneura* pt. preoc.) Morellia Desvoidy.

16. Eyes pilose. . . . . Myiospila Desvoidy.
Eyes bare. 17

17. The first vein terminates at tip of costa; fourth vein with a distinct curvature near tip of wing (*Cyrtoneura* pt. preoc.) Muscina Desvoidy.
The first vein terminates before the middle of the costa; fourth vein scarcely curved forward at its distal end. Clinopera v. d. Wulp

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56. TACHINIDÆ. 57. DEXIIDÆ.

Rather small to rather large, bristly flies, thinly or not at all pilose, usually thick-set. Eyes of the male contiguous or more approximated than in the female, pubescent or bare. Front with a row of bristles on each side, descending to the antennæ, with or without orbital bristles. First joint of antennæ short; second joint usually shorter than the third; third joint usually more or less elongate, sometimes dilated or fissured; decumbent; arista bare (Tachinidæ), pubescent or plumose (Dexiidæ), sometimes conspicuously jointed. Face always with a well-marked median depression, which sometimes has a carina in its middle. Proboscis sometimes elongate, but usually short and with broad labella; palpi never with more than one articulated joint, which is sometimes rudimentary. Ocelli present. Abdomen composed of four or five visible segments; with marginal and lateral and usually with discal bristles; sometimes nearly covered with strong, erect spines. Legs usually rather stout; sometimes elongate and slender (Dexiidæ); always bristly. All the veins of the wings simple; basal cells large; three posterior cells present, the first of which

is always narrowed or closed(save in those rare cases in which the distal section of the fourth is obliterated); auxiliary vein distinct in its whole length. Tegulae large.

No other group of flies has presented so many difficulties to the student of systematic dipterology as has the present one. In its entirety, with but few exceptions, it is easily enough differentiated. Flies in which the arista is bare, the tegulae are well developed, and the first posterior cell is narrowed or closed, may be unhesitatingly referred to the Tachinidæ. The Dexiidæ gradually merge into that family, and it is not always easy to positively distinguish them. The presence, however, of aristal plumosity with the other characters of the more typical Tachinids, that is, those in which the dorsum of the abdomen is distinctly bristly, will remove doubt of the correct location of any species possessing such characters. Unfortunately the differentiation of the genera and species is vastly more difficult, and will require much patient and exhaustive study before a satisfactory solution is reached. About two hundred and seventy-five genera, or one-fifth of all the dipterological fauna, have already been accredited to North America. Some of the names proposed will unquestionably be reduced to synonyms, but not many, as the characters used for generic distinctions are often exceedingly slight. So inconspicuous are the characters in many species that only the practiced eye will detect them.

I have not attempted to define or tabulate the genera. To do so, even imperfectly, would require far more time than is at my command. The best that I can do now is to give a fairly complete list of the genera said to occur in North America, with their bibliograpical references. For further study, the student is referred to the works of Brauer and Bergenstamm, the various papers of Townsend and Coquillett, and the volume of the Biologia Centrali-Americana by van der Wulp.

The habits of the mature fly are similar for nearly all the members of the group. They will be found on vegetation, on

leaves or flowers, in such places as are frequented by the hosts which they parasitize. Not a few will be caught with the beating net.

The larvæ of the more typical Tachinidæ are thickened, cylindrical and flattened below, the segments indistinctly differentiated, with transverse and lateral swellings, bare or provided with fine, short spines. They are amphipneustic, the anterior spiracles small and point-like or multipartite, the posterior stigmatic plates large, strongly chitinized, and each with three, internally convergent grooves. The antennæ are wart-like, with two, ocellus-like, chitinous rings, one lying below the other. There but two mouth-hooklets, porrect and but little curved. The puparia are oval, with the segments slightly differentiated; the skin is finely wrinkled, and both ends are rounded.

In *Ocyptera* and *Gymnosoma*, and probably in allied forms, the larvæ have a chitinous, anal stigmatic tube; and the puparia have six or two, similar processes. The larvæ of *Hyalomyia* are translucent, smooth and metapneustic, the mouth-hooklets very large; there are two, short, divergent, anal tubes.

The larvæ of this group are all parasitic in habit, so far as is known, and the parasitism is probably confined to the early stages of other insects. Their usefulness in keeping injurious insects in check is immeasurable.

By far the largest number of species are parasitic upon Lepidoptera, of which not less than four hundred have been recorded. About seventy species are known to be parasitic upon Hymenoptera, less than forty upon Coleoptera, eighteen upon Orthoptera, five upon Hemiptera, and as many upon other Diptera.

More particularly the observed parasitism of some of the North American genera is as follows:

Achaetoneura, *Caloptenus, Danais, Citheronia, Datana, Prodenia, Sphinx, Vanessa, Anisota, Atacus, Clisiocampa, Heliotis, Prodenia, etc.;* Argyrophylax: *Euchætes, Schiz-*

ura, Ceratomia, Danais, Hemileuca; BESSERIA: *Diabrotica;* BLEPHARIDIA: *Pieris, Botis;* BLEPHARIPEZA: *Halisiota, Spilosoma;* CHAETOLYGA: *Adoneta, Agrotis, Alypia, Datana, Leucania, Sphinx;* CTENOPHOROCERA: *Cerura;* DEXODES: *Arzama;* ELACHIPALPUS: *Sesia;* EUMYOTHYRIA: *Lophyrus;* EUTACHINA: *Saturnia;* FABRICIA: *Agrotis;* GONIA; *Laphygma, Bombus;* GYMNOPROSOPA: *Leucania;* GYMNOSTYLIA: *Tenthrinidæ;* JURINEA: *Ecpantheria;* LATREILLIA: *Anisota, Citheroia, Dryocampa;* MICROPALPUS: *Sesia;* MYEXORISTA: *Acronycta, Lagoa;* NEMORAEA: *Hypantria;* NEMORILLA: *Hyponomeuta;* OCYPTERA: *Acridioidea, Leucania;* PARAFRONTINA: *Sphinx;* PAREXORISTA: *Hadena, Mamestra;* PHORICHAETA: *Noctuids;* PHOROCERA: *Botys, Megathymus, Anœa, Chlorippe, Vanessa, Argynnis, Cinclidia, Loxosiega;* PLAGIA: *Plusia;* PROSOPAEA: *Aletia, Smerinthus;* PSEUDOMYOTHYRIA: *Diabrotica;* SIPHONA: *Plusia;* SISYROPA: *Acronycta, Agrotis, Arachnis, Lagoa, Notodonta;* SPHIXAPTA: *Pilopœus;* THELAIRA: *Phakellura;* THRYPTOCERA: *Retinia;* TRICHOPODA: *Anasa, Dissosteira.*

LIST OF GENERA.

1 Acaulona Wulp, 7, 4.
2 Acemyia Rond., Prod.
3 Achætoneura B. B., II, 334.
4 Acrocantha Wulp, 7.
241 *Acroglossa* Will., 9.
5 Admontia B. B., I, 104.
6 Alophora R-D., Myod.
7 Amedoria B. B., I, 106.
8 Ammobia R-D., Myod.
9 Angiorhina B. B., I, 163.
10 Anisia Wulp, 7, 186.
11 Anthracomyia Rnd., Prod.
12 Aphria R-D., Myod
13 Araba R-D., Myod.
14 Araenopus B. B., I, 361.
15 Archytas Jænn. N. Ex. Dipt., 392.
16 Argyraphylax B. B., I, 163.
17 Atacta Schiner, Nov. Exped:
147 *Atropharista* Town., 34, III, 192.
18 Atrophopalpus Town., 18.
19 Atrophopoda Town., 34, III, 373.
20 Baumhaueria Mgn, Syst. Bes .vii, 251.
21 Bathydexia Wulp, 7, 222.
22 Belvosia R-D., Myod., 102.
23 Beskia B. B., i, 139.
24 Besseria R-D., Myod.
25 Blepharidea Rnd., Prod.
26 Blepharipeza Macq., D.E., ii, 3, 341.
27 Bolomyia B. B., II, 347.
28 Bombyliomyia B. B., I, 131.
29 Brachycoma Rnd. Prod. iii, 203.
30 Calodexia Wulp, 7. 257.
31 Camarona Wulp, 7, 247.
24 *Celatoria* Coq., Ins. Life, ii, 253.
32 Ceromasia Rond. Prodr.
33 Ceratomyiella Town., 34, III, 379.

34 Cestonia Rond., Dipt. Pr.
35 Chaetogaedia B. B., 1, II, 336.
36 Chaetoglossa Town., 34, III, 125.
37 Chaetolyga Rond., Dipt. Pr.
38 Chaetona Wulp, 7, 253.
39 Chaetoplagia Coq., 32, 98.
40 Chaetophleps Coq., 31, 51.
41 Cholomyia Big., 42, xxxvii.
42 Chrysotachina B. B., 1, I, 161.
43 Cistogaster Latr., An. Reg., v,'29
44 Clausicella Rond., Dipt. Pr.
45 Clinogaster Wulp, 3, 189.
46 Clinoneura B. B., 1, I, 119
47 Clista Meig., Syst. Bes., vii, 208.
48 Clistomorpha Town., 18, 170.
49 Clytiomyia Rond., Dipt. Pr. iv, 9.
49 *Clytia* R.-D., Myod. 1830.
50 Coenosoma Wulp, 7, 166.
131 *Comyops* B. B , 1, I, 358.
51 Cordylogaster Macq.,D.E.,ii,3,60.
52 Cnephalia R.-D., Myod. 1830.
53 Cryptomeigenia B. B., 1, II, 311.
54 Cryptopalpus Rond., Dipt. Pr.
55 Cyphocera Macq., Ann. Soc. Ent. ii, 2, 267, 1845.
56 Ctenophorocera B. B., 1, II, 339.
57 Cyrtophlebia Rond., Dipt. Pr.
58 Daeochaeta Town., 34, III, 97.
59 Degeeria Meig., Syst.Bes.vii,249.
60 Dexia Meig., Syst. Beschr., v, 33.
61 Dexodes B. B., 1, I, 87.
62 Dexiosoma Rond., Dipt. Pr. i, 85
63 Dichocera Will., 57.
64 Didyma Wulp, 7, 156.
65 Distichona Wulp, 7, 40.
66 Drepanoglossa Town., 34, II, 377.
67 Echinomyia Dumeril, 1798.
68 Elachipalpus Rond.
69 Enyomma Towns., 34, 371.
70 Epalpus Rond.
71 Epigromyia Towns., 34, II, 375.
72 Erigone R.-D., Myod. 1830.
73 Ervia R.-D., Myod., 1830.
74 Euantha Wulp, Tijd. Ent. xxvii.
75 Eucnephalia Towns., 34,166.
76 Eudexia B. B. 1, I, 120.
77 Eumacronychia Town., 34,III,100
78 Eulasiona Towns., 34, III, 100.
79 Eutachina B. B., 1, I, 98.
80 Euphanopteryx Towns.,34,III,121.
81 Euphorocera Towns., 34, III, 112.
82 Euryceromyia Towns., 34, III, 115.
83 Euscopolia Towns., 34, III, 123.
84 Euthera Loew, Cent. vii, 85, 1866.
85 Euthyprosopa Towns., 34, III, 106.
86 Exorista Meig.,Illiger's Mag.1803.
87 Fabricia R.-D., Myod. 1830.
88 Frontina Meig.,
89 Gædiophana B. B., iii, 113.
90 Gaediopsis B. B., 1, I, 336.
91 Ginglimyia Town. 34, III, 118.
92 Gonia Meig., Ill. Mag. ii.
93 Goniachaeta Town., 34, II, 251.
94 Gymnochaeta R.-D., Myod.
95 Gymnoclytia B. B. 1. III, 157.
96 Gymnodexia B. B. II, 364.
97 Gymnomma Wulp, 7, 38.
98 Gymnopareia B. B., 1, I, 103.
99 Gymnoprosopa T'd., 34, III, 108.
100 Gymnophania B. B., 1, I, 143
101 Gymnosoma Meig., Ill. Mag., ii.
102 Gymnostylia B. B., 1, I, 128.
103 Hemithrixion B. B., 1, I, 114.
104 Hemimasicera B. B., 1, I, 87.
105 Hemyda R.-D., Myod. 226.
106 Hesperomyia B. B., 1, I, 114.
107 Himantostoma Lw, Cent. iv, 87.
108 Homodexia Big., 44.
109 Hyalomyia R.-D., Myod. 298.
110 Hypantrophaga Town., 7, 258.
111 Hypertrophocera Towns., 34, II, 360.
112 Hyposteua Meig., Syst. Beschr., vii, 289.
113 Hyria R.-D., Myod.
114 Hystricia Macq., D. E., ii, 3, 43.

115 Hystricodexia Roed., Stett. Ent. Zeit. 1886, 266.
116 Hystrisiphona Big., Rev. et M. Zool. 1859.
117 Illigeria R.-D., Myod., 273.
118 Isoglossa Coq., Can Ent.'95, 125
119 Jurinia R.-D., Myod., 34.
120 Jurinella B. B., 1, 1, 132.
121 Labidogaster Macq., Ins. Dipt. de la Nord de France, 109.
122 Laccoprosopa Town., 34, II, 365.
123 Lacnomma Town., 34, III, 103.
124 Lasiona Wulp, 7, 127.
125 Lasioneura Coq., J. N. Y. Ent. Soc. iii, 50.
126 Latreillia R.-D., Myod.
127 Leptoda Wulp, Tijdschr. voor Ent. xxviii, 196.
128 Leskiomima B. B., 1, II, 872.
129 Leucostola Mgn, Ill. Mag. ii.
130 Lispidia Coq. 31, 51.
131 Loewia Egger, V. Z.-B. G.
132 Macquartia R.-D., Myod. 204.
133 Macrochaetina Wulp, 7, 240.
134 Macromeigenia B. B., I, 311.
135 Macrometopa B. B., I, 117.
136 Macronychia Rond. Dipt. Pr.
137 Macroprosopa Macq.D.E. ii, 3, 83.
138 Mascopteryx Town., 18, 170.
139 Masicera Macq. II. N. D. ii, 118.
140 Masipoda B. B. I, 162.
141 Masiphya B. B., II, 113.
142 Megaprosopus Macq.
143 Megerlea R.-D., Myod. 266.
144 Megaparia Wulp, 7, 240.
145 Meigenia R.-D., Myod.
146 Melanophora Mgn, Ill. Mag. ii
147 Melanophrys Will., 48, 305.
148 Melaleuca Wulp, 7, 247.
149 Melanodexia Will., 67.
150 Mesochæta B. B., II, 341.
151 Metachæta Coq., 32, 98
152 Metaplagia Coq., 32, 102.
153 Metopia Mgn. Ill. Mag. ii.
154 Microchira B. B., iii, 100.
155 Micropalpus Macq., H. N. D. ii, 80.
156 Microphthalma Macq., D. Exot. ii, 3, 84.
157 Miltogramma Mgn. Ill. Mag. ii.
158 Mochlosoma B. B., I, 128.
159 Morinia R-D., Myod., 99.
160 Morphomyia Rnd., Prod.
161 Myiophasia B. B., II, 362.
162 Myiobia R-D., Myod., 99.
163 Myiocera R-D., Myod. 328.
164 Myiomima B. B. I, 009.
165 Myiopharus B. B. I, 161.
166 Myiostoma R-D., Myod.
167 Myiothyria Wulp, 7, 208.
168 Mystacella Wulp, 7, 51.
169 Myexorista B. B., II, 351.
170 Nemoræa R-D., Myod. 70.
171 Nemorilla Rond., Prod.
172 Neotractocera Town., 34, III, 104.
173 Ocyptera Latr. H. N. Cr. xiv.
174 Ocypterula Rdi, Prod.
23 *Ocypterosipho* Town.
50 *Oestrophasia* B. B., 1, I, 357.
176 Olenochæta Town., 84, III, 115.
177 Opsidia Coq., 32, 102.
178 Pachyophthalmus B. B., I, 117.
179 Paradejeania B. B. III, 147.
180 Paradidyma B. B., II, 404.
181 Parafrontina B. B., III, 115.
182 Parahypochæta B. B., II, 337.
183 Paramesochæta B. B., II, 341.
184 Paraphorocera B. B., I, 90.
185 Paraplagia B. B., II, 354.
186 Parexorista B. B., I, 87.
187 Parthenia R-D., Myod., 322.
188 Pelcteria R-D., Myod.
189 Penthosa Wulp, Tijd. voor Ent. xxxiv, 98, 1892.
190 Phania R-D., Myod. 233.
191 Phasioclista Town., II, 369.
192 Phasiopteryx B, B. I, 146.

193 Phorantha Rdi, Prodr.
194 Phorichæta Rdi, Prodr.
195 Phorostoma R-D., Myod., 326.
196 Phyto R-D., 218.
197 Phorocera R-D., 131.
198 Plagia Mgn, S. B. vii, 291.
199 Plagioprospherysa Td, 34, ii, 113.
200 Podotachina B. B., ii, 350.
201 Polidea Macq. Ann. Soc. Ent. F., ii, 6, 92, 1848.
202 Polygaster Wulp, 7, 139.
203 Prorhynchops B. B., ii, 364.
204 Prosena St. F. & S., Enc. Meth.
205 Prosenoides B. B., ii, 370.
206 Prosopæa Rdi.
207 Prosopodes B. B., i, 90.
208 Pseudochæta Coq., 33, 309.
209 Pseudogonia Town., 19.
210 Prospherysa Wulp, 7, 117.
211 Pseudogermaria, B. B. ii, 352.
212 Pseudohystricia B. B., i, 132.
213 Pseudomorinia Wulp, 7, 209.
214 Pseudomyiothyria Town., iii, 131.
215 Pseudotractocera Town., iii, 107.
216 Ptilocera R-D., 226.
217 Ptilodexia B. B. i, 119.
221 *Rhamphinina* Big. 45.
218 Pyrhosia Rdi.
219 Rhinophora R-D., 258.
220 Rhombothyria Wulp, 7, 259.
221 Rhynchodexia Big., 45.
222 Rileya B. B. (preoc.)
223 Sarcoclista Town:, 34, iii, 122.
224 Sarcodexia Town., 52.
225 Sarcomacronychia Td, iii, 100.
226 Sarcotachinella Town., 34, iii, 110.
227 Sardiocera B. B., i, 119.
228 Saundersia Sch., Nov. Ex. 333.
229 Schizotachina Walk., D. Saund.
230 Scopolia R-D., 268.
231 Scotiptera Macq., D.E., ii, 3, 637.
232 Senotainia Macq., l. c , Sup. i, 16
233 Sericocera Macq., H. N. D. ii, 165.
234 Siphoclyta Town., 34, iii, 115.
235 Siphoclytes Town., 34 iii, 127.
236 Siphona Mgn. Ill. Mag. ii.
237 Siphoplagia Town., 34, i, 350.
238 Siphophyto Town.
239 Sisyropa B. B., i, 163.
240 Somoleia Rdi.
241 Spallanzania, Rdi.
242 Sphærina Wulp, 7, 205.
243 Sphixapata Rdi.
244 Stenodexia Wulp, 7, 246.
245 Stevenia R-D., 220.
246 Stomatodexia B. B., i, 125.
247 Synthesiomyia (See Muscidæ.)
248 Tachina Mgn, Ill. Mag.
249 Tachinodes B. B., i, 133.
250 Tachinomyia Town., 34, iii, 96.
251 Tachinophyto Town., 34, iii, 130.
252 Telothyria Wulp, 7, 167.
253 Tetragrapha B. B., ii, 351.
254 Thelaira R-D., Myod. 214.
255 Thelairodes Wulp, 7, 254.
256 Theresia R.-D., Myod., 325.
257 Thomodesia Rnd., D. Pr., i, 87.
258 Thryptocera Macq., H.N.D. ii, 87.
259 Thysanomyia B. B., II, 340.
260 Tricophora Macq. D.E. S. 2, 62.
261 Tricolyga Rnd. D. Pr.
262 Trichopoda Cuv. Reg. An. v.
263 Trixa Mgn, Syst. Bes., iv, 222.
264 Trixoclista Town., 34, III, 102.
265 Tryphera Mgn. Syst. Bes.
266 Uramyia R.-D., Myod., 215.
267 Viviana Rnd., D. Pr.
19 *Vanderwulpia* Town., 34, II, 381.
268 Wahlbergia Zett. D. Scand..
269 Willistonia B. B., I, 97.
19 *Wulpia* B. B., 44.
270 Xanthodexia Wulp, 7, 256.
271 Xanthomelana Wulp, 3, 187.
272 Zelia R.-D., Myod., 134.

58. HIPPOBOSCIDÆ.

Head flattened, usually attached to an emargination of the thorax; face short; palpi wanting; antennæ inserted in pits or depressions near the border of the mouth; apparently one-jointed, with or without a terminal bristle or long hairs. Eyes round or oval, sometimes very small; ocelli present or absent. Thorax flattened, leathery in appearance; scutellum broad and short. Halteres small or rudimentary. Abdomen sac-like, leathery in appearance, the sutures indistinct. Legs short and strong, broadly separated by the sternum; tarsi short; claws usually strong and dentated; empodia usually present. Wings present or absent.

Not very many species of this singular family of flies are known. They are all parasitic in the adult stage upon birds or mammals. The larvæ are pupigerous, but pass nearly the whole of this stage within the abdomen of the parent, being extruded when nearly ready to transform into the mature fly. But a single puparium is extruded at a time and is of large size. The flies have a peculiar, louse-like appearance, and one often encounters them in handling recently killed birds, especially the raptorial birds. They have a quick, short flight, seeking the beard or hair of the collector, within which they run nimbly, trying to hide. In *Lipoptena* the wings are apparently lost soon after the insect finds a permanent living place.

I have united *Strebla* and its allies with this family, an opinion shared by Professor Townsend, but have separated them as a subfamily. I believe that their relationships are closer here than with the Nycteribiidæ.

TABLE OF GENERA.

1. Antennæ small or indistinct; head not sunken into the emarginate thorax; wings large, with distinct, parallel veins and distinct outer cross-veins; claws short, simple. . . . . STREBLINÆ.

Antennæ usually more elongate and the joints more or less distinctly separated. Head sunk into an emargination of the thorax. Wings when present without parallel veins, the weak veins running from the strong costal veins outwards and backwards, the cross-veins short, and approximated to the base of the wing; claws large, bidentate or tridentate. . . . . HIPPOBOSCINÆ.

STREBLINÆ.

1. Eyes small, situated on the posterior angles of the head.
Strebla Wiedemann.
Eyes situated near the middle of the head (Mexico).
Trichobius Townsend.

HIPPOBOSCINÆ.

1. Claws tridentate. 2
Claws bidentate. 3

2. Wings rudimentary; ocelli wanting. Brachypteromyia Williston.
Wings large, functional; ocelli present. Ornithomyia Latreille.

3. Wings wanting or rudimentary, in the males at least. . . . 4
Wings present, functional, ... 5

4. Eyes very narrow and situated on the sides of the head; no ocelli.
Melophagus Latreille.
Eyes larger, oval; ocelli present, but sometimes indistinct; wings caducous in one or both sexes. . - . Lipoptena Nitsch.

5. Antennæ short, tuberculiform. . . . Hippobosca Linne.
Antennæ elongate, clothed with hair distally. . Olfersia Leach.

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59. NYCTERIBIIDÆ.

Head small, capable of being turned backward into a groove on the dorsum of the thorax. Antennæ short, indistinctly jointed, the terminal joint oval, with short hairs. Eyes and ocelli indistinct or wanting. Legs long, the femora and tibiæ flattened. Tarsi arcuate. No wings.

These peculiar flies, like those of the foregoing family, are pupiparous. They live exclusively on bats. But little is known of their early stages. (See Osten Sacken.) The flies have a peculiar, spider-like appearance, which is heightened by the habit they have of throwing their legs up over their back when at rest. But two or three species are known from North America, and they are rare. I have never seen them.

TABLE OF GENERA.

1. Metatarsi elongate. . . . . Nycteribia Westwood.
Metatarsi short. . . . . Megistopoda Macquart.

APPENDIX.

During the printing of this work there have been a number of genera added to the fauna of the region included within its limits. I give them as they should be intercalated in the tables, together with some that have been omitted or overlooked, though previously known. The student is requested to make marginal references wherever they should be intercalated.

LEPTINÆ, p 44.

2. Front tibiæ with a single spur. 2a
   Front tibiæ with two spurs, etc. . . . TRIPTOTRICHA Loew.

2a. Antennal style jointed; fourth posterior cell closed (Central America and West Indies). . . . . PHENEUS Walker.
   Antennal style not jointed; fourth posterior cell open, or wanting. DIALYSIS Walker.

STRATIOMYINÆ, p. 48.

6. Antennæ much elongated, ... 7
   Third antennal joint oval, with a terminal arista. NOTHOMYIA Loew.

7. Face produced conically downward. . . MYXOSARGUS Brauer.
   Face not produced conically downward. 8

8. Third joint of the antennæ composed of six closely united annuli, without style or arista; wings expanded distally (Central and South America). . . . . ANALCOCERUS Loew.
   Third antennal joint composed of seven closely united annuli, without style or arista; wings not expanded distally (Central America and East Indies). . . . . CAMPEPROSOPA Macquart.

These last two genera belong among the Sarginæ, but have no terminal arista.

PACHYGASTRINÆ, p. 48.

1. Antennæ situated near the oral margin. 2
   Antennæ situated near the middle of the head in profile. . . 1a

1a. Arista with a short, dense plumosity (Central America and Polynesian Islands). . . . . LOPHOTELES Loew.
   Arista bare. 3

DASYPOGONINÆ, p. 54.

2. Pulvilli rudimentary or wanting. 2a
Pulvilli normal. 2b

2a. Claws very long, with an elongated tooth at the base of each; large species (Central and South America). . . DICRANUS Loew.
Claws normal. . . . . ABLAUTUS Loew.

2b. Antennæ with a long, terminal arista (Cen. America and East Indies). DAMALIS Wiedemann.
Antennæ not with a terminal arista. 2c

2c. Only four posterior cells present; front very broad above; very small species (Mexico). . . . . TOWNSENDIA Williston.
Five posterior cells present as usual. 3

ASILINÆ, p. 59.

4. Oviduct cylindrical, with a terminal circlet of spines. . . . 4a
Oviduct laterally flattened, etc. . . . . ERAX Macquart.

4a. Abdomen shorter than the wings. . . . ECCRITOSIA Schiner.
Abdomen longer than the wings. . . PROCTACANTHUS Macquart.

7. Oviduct laterally compressed. 7a
Oviduct conical. 14

7a. Third antennal joint unusually hairy. . . ANARMOSTUS Loew.
Third antennal joint not unusually hairy. 8

NEOPLASTA Coquillett, Proc. Nat. Mus. 1895, 393 (June, 1896. Same as *Hemerodromia*, but the discal and second basal cells united and the second posterior cell sessile.

EMPIMORPHA Coquillett, l. c. 398. "Same as *Empis*, except that the face is covered with long bristly hairs."

NEOCOTA Coquillett, l. c. 434. "Same as *Rhamphomyia*, except that the face is thickly covered with long pile."

MICROPHORUS Macquart, Dipt. du Nord, etc. 1827. Separated from *Leptopeza* and *Ocydromia* of the table by the third antennal joint being elongate, with a terminal style.

MEGHYPERUS Loew, Stett. Ent. Zeit. 1850, 303. Separated from *Hybos* and *Syndyas* of the table by the fourth longitudinal vein being furcate.

PARAHYDROPHORUS Wheeler, Entom. News, 1896, 185. "Closely allied to *Scellus* and *Hydrophorus*, the ♂ distinguishable from the ♂ *Hydrophorus* by the deep notch in the fore femora, the prominent spur on the hind trochanter, and the structure of the hypopygium."

INDEX.

Those genera added to the North American fauna since the publication of Osten Sacken's Catalogue in 1878 are followed by Roman and Arabic numbers referring to the authors and papers of the bibliography given in the Introduction and below. The genera of the Tachinidæ and Dexiidæ are not included; they will be found on page 147.

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